X-7014

SUPPLEMENT
to
MAINTENANCE MANUAL
X-6814

THIS SUPPLEMENT REPLACES ADVANCE
MAINTENANCE MANUAL X-7014 P

GMC
COACHES

COACH MODELS
PD-4108 & PD-4905

55033
COACH INFORMATION NETWORK
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Pontiac, Michigan

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Introduction

Information contained in this supplement, when used in conjunction with Maintenance Manual X-6814, provides all the procedures and data required to adequately service coach models PD-4108 and 4905.

The information in this supplement is arranged in the same sequence and under the same section headings as in Manual X-6814.

Refer to the applicable section in this supplement first, to determine whether there is supplementary information before servicing any unit or system on these coaches. If there is none, then service unit or system in accordance with Maintenance Manual X-6814.

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NOTE: Coach Wiring Diagrams are included in separate publication X-7014A.

SECTION 2

Rear Axle

All information pertaining to REAR AXLE as described in Maintenance Manual X-6814, pages 9 - 22, is applicable to models covered by this supplement with the exception of the following:

Components of the differential assembly are identical on both coach models with the exception of the drive gear and pinion. The rear axle ratio on the PD-4108 is 4-1/8 to 1, and the ratio on the PD-4905 is 4-3/8 to 1.

It is important to note that the axle shafts are not interchangeable between models. Each axle shaft is held in position on the hub studs by ten nuts on Model PD-4108.

On Model PD-4905 each axle shaft is retained by seven nuts. The torque on these axle shaft flange nuts is 100-110 foot-pounds for both coach models.

SECTION 3

Body

All information in BODY (SEC. 3) in Maintenance Manual X-6814 also applies to coaches covered by this supplement except as specifically stated in the following procedures:

General Body Maintenance

SIDE WINDOWS

Standard equipment on coaches covered by this supplement is solid glass windows (fig. 1 shows end view). Some coaches have sliding sash windows as special equipment as covered in Maintenance Manual X-6814. Emergency escape mechanism following is the same for both types.

EMERGENCY ESCAPE

The entire side window sash can be opened from the inside for escape. Windows are hinged at top and can be opened by pushing out at the bottom.

Coaches are equipped with passenger instruction decal as shown in figure 2.

An escape mechanism guard rail (fig. 1), is hinged at the bottom and covers mechanism to prevent accidental release. To open window pull rail down and release latch by pulling release cable. When latch is released, push the window out at the bottom.

IMPORTANT: Whenever it is noted that a side window is open, window must be closed immediately. Close window by pulling window inward and latching. DO NOT SLAM TO CLOSE.

To close window, use suction cup (fig. 3) and pull window closed. While holding window closed release lock by lifting lock spring (fig. 4). Use suction cup at both front and rear of window and release lock springs separately.

WIPER MOTOR REPLACEMENT AND OVERHAUL

REPLACEMENT

Removal

1. Remove wiper arm linkage at front of windshield. Remove spanner nuts and seal washers from motor linkage shafts.
2. Exhaust pressure from air supply system.
3. Disconnect air lines at wiper motor.
4. Remove two bolts which attach motor bracket to body panel. Remove motor unit.

Installation

1. Place wiper motor with assembled linkage into position and attach to body panel with two bolts. Also, at front of vehicle install spanner nut which retains motor shaft in position. Tighten nut to 18 to 20 foot-pounds torque.
2. Connect air lines to motor valve ports.
3. Build up air supply (65 psi or more).
4. Operate motor. While observing the cycling of wiper arm shaft, turn wiper off when shaft is located in "PARK" position (blades park at center of windshield). Apply small quantity of Special Lubricant (S17) to motor and pivot shafts. Refer to LUBRICATION (SEC. 13) of this supplement for

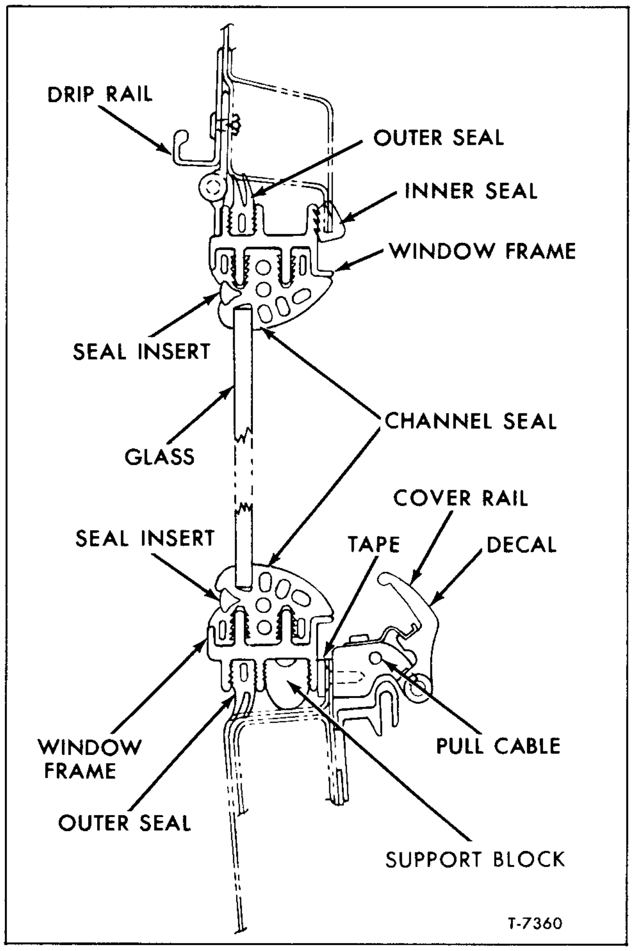


Figure 1—End View of Solid Glass Sash

description of Special Lubricant (S17). Engage wiper arm over serrations of shaft. Tighten arm clamp screw and install crown nut to pivot shaft.

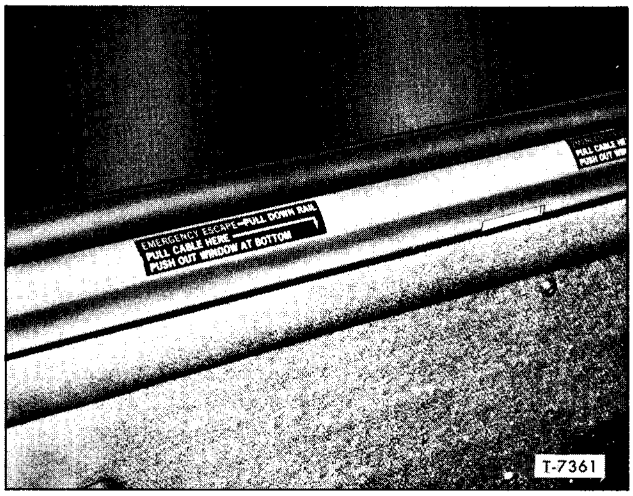


Figure 2—Emergency Decal

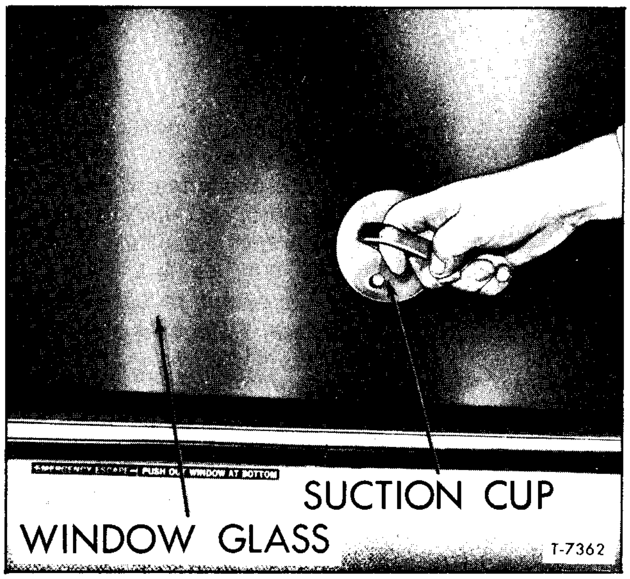


Figure 3—Closing Window

OVERHAUL (Refer to Fig. 5)

NOTE: A kit is available including all necessary parts to properly service motor. Repair kits are available through authorized GMC Wholesale Warehouse.

Separation of Major Sub-Assemblies

1. Remove retainer which attaches link to motor shaft assembly.

2. Remove screw and washer which attach motor transmission shaft into wiper motor. Pull shaft assembly from motor assembly.

3. Remove four bolts which attach mounting bracket assembly to motor. Remove bracket.

4. Remove four screws which attach wiper control valve body to motor piston body assemblies. Remove valve body and body O-rings. Figure

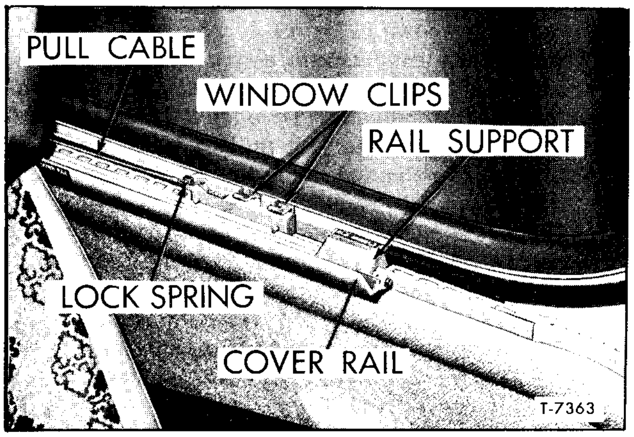
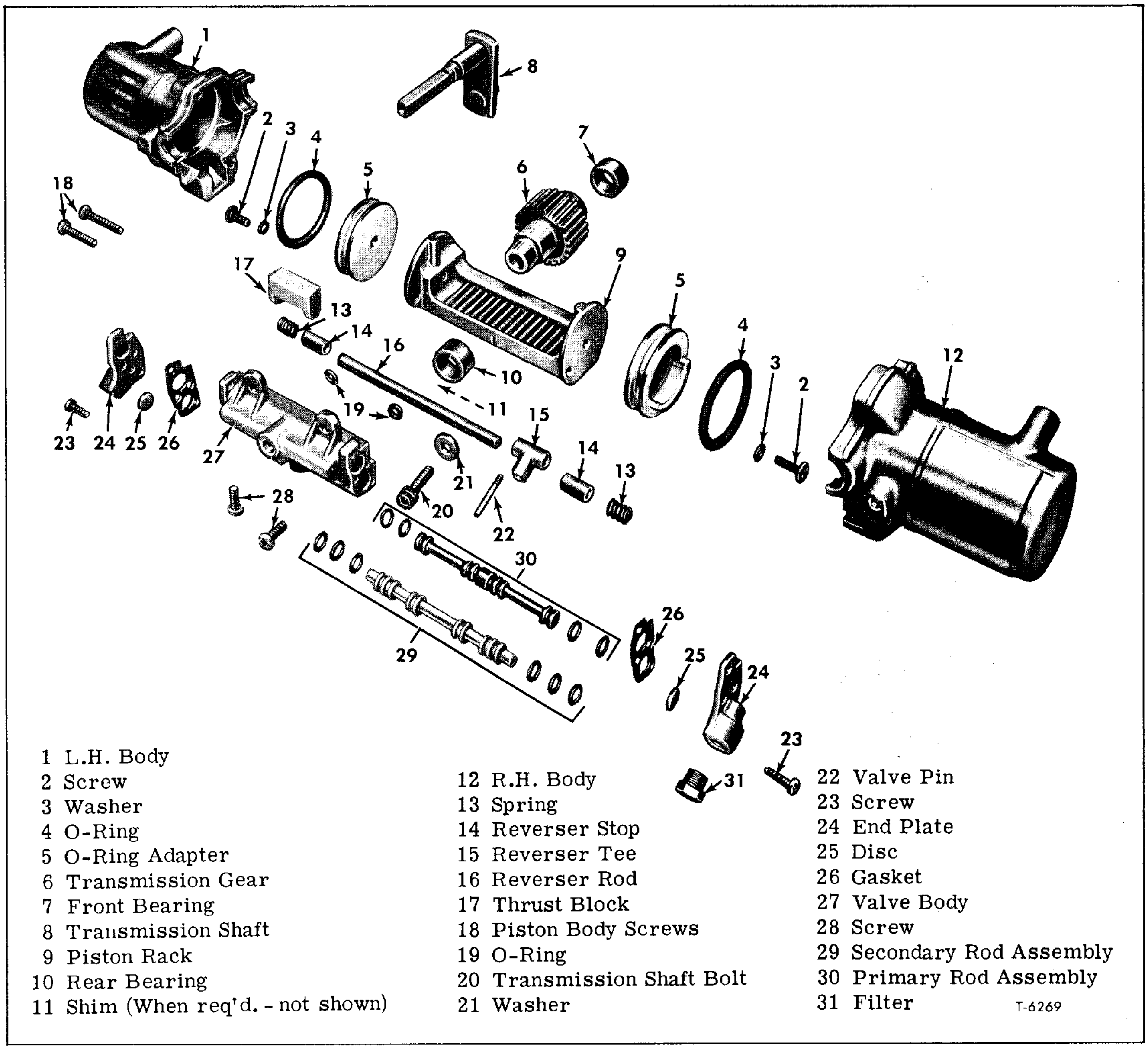


Figure 4—Escape Mechanism



1 L.H. Body
2 Screw
3 Washer
4 O-Ring
5 O-Ring Adapter
6 Transmission Gear
7 Front Bearing
8 Transmission Shaft
9 Piston Rack
10 Rear Bearing
11 Shim (When req'd. - not shown)
12 R.H. Body
13 Spring
14 Reverser Stop
15 Reverser Tee
16 Reverser Rod
17 Thrust Block
18 Piston Body Screws
19 O-Ring
20 Transmission Shaft Bolt
21 Washer
22 Valve Pin
23 Screw
24 End Plate
25 Disc
26 Gasket
27 Valve Body
28 Screw
29 Secondary Rod Assembly
30 Primary Rod Assembly
31 Filter

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Figure 5—Windshield Wiper Motor Components

6 shows body separated.

5. Place right half of piston body (half with threaded screw holes) in vise so that attaching screws are up.

CAUTION: Tighten vise ONLY enough to hold body.

6. Remove screws which attach piston bodies together.

7. Slowly lift off upper piston body.

8. Note position of alignment marks on gear and piston rack (fig. 7). Mark on gear is on rear side of gear tooth. Mark on rack is cast in rack at center line. Remove gear assembly, noting locations of thick and thin bearings.

9. Remove thrust block.

10. Note position of valve reverser tee in body slot, and remove the piston assembly.

11. Clean all parts in alcohol and blow dry with compressed air. Inspect all parts for damage or wear and replace if required.

NOTE: Some solvents may be detrimental to parts.

Build-up of Major Sub-Assemblies

1. Apply clean wiper motor grease to all moving or sliding parts.

BODY

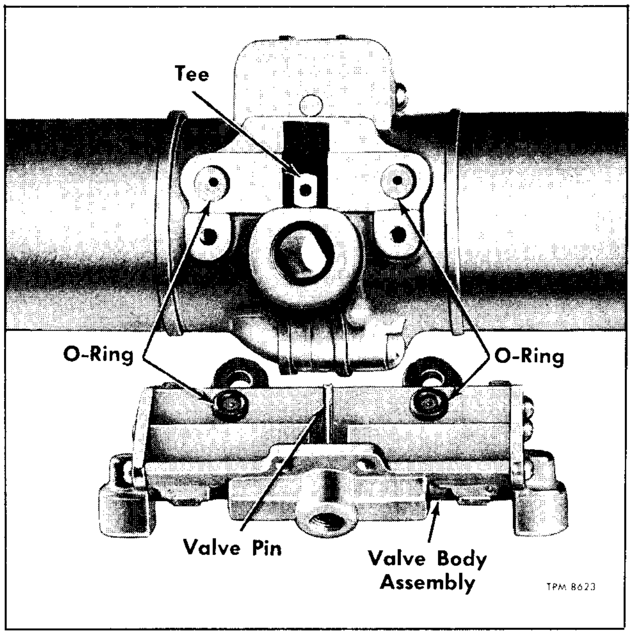


Figure 6—Windshield Wiper Motor Valve Body Removed

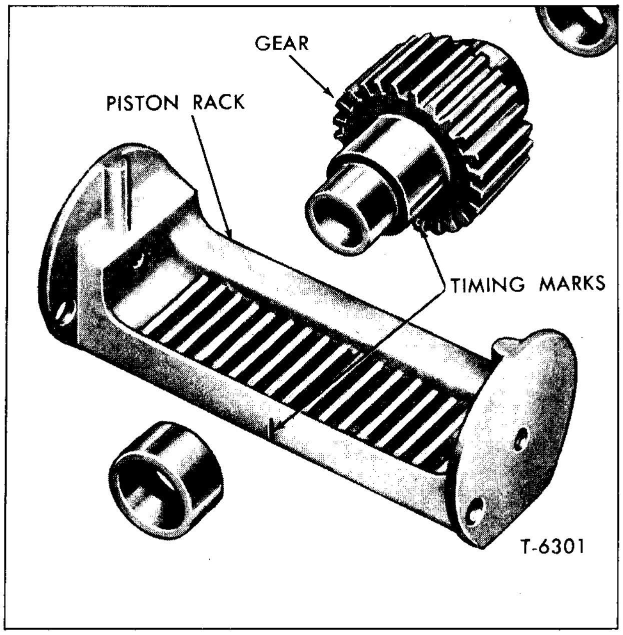


Figure 7—Gear To Piston Rack Timing Marks

2. With right piston body assembly placed in vise, install piston assembly into piston body.

3. Install thrust block. Make sure pin notch is properly positioned to align with body attaching screw later.

4. Assemble bearings with shim washers (if used or needed) on gear and sleeve assembly. Use shim washers with bearings when end play exceeds 0.010".

NOTE: Install gear and bearings into body. Make sure alignment marks on gear and rack are aligned (fig. 7).

5. Install left piston body assembly over piston assembly. Attach bodies together with screws Tighten screws firmly.

6. Referring to figure 6, place O-rings on bosses of valve body as shown. Carefully place valve body to motor piston bodies, then install valve body attaching screws. Tighten screws firmly.

7. Attach mounting bracket to motor with four bolts and lock washers.

8. Install motor transmission shaft assembly to motor, making sure shaft link is positioned to align with upper wiper arm shaft lever. Install washer and shaft retaining screw.

9. Install link in shaft and secure with retainer.

Wiper Motor Valve Disassembly and Assembly

1. Remove screws, then remove parking end plates and gaskets from valve body. Remove discs from end plates.

2. Unscrew valve pin projecting from valve body side.

3. Push out primary rod and secondary rod from valve body.

4. Remove rubber O-rings from rods.

5. Clean the valve body, end plates, mounting screws and rods with alcohol and wipe rubber O-rings with clean cloth. Examine all parts for wear and defects. Replace all worn and defective parts.

6. Apply S17 Lubricant to valve rods and rubber O-rings.

7. Install rubber O-rings on rods, then push rods into valve body.

NOTE: Make sure tapped hole in primary rod is in position to align with valve pin.

8. Thread valve pin into primary rod.

9. Make sure rubber discs are installed in end plates. Install end plates to valve body with screws.

Wiper Motor Piston Disassembly and Assembly

1. Remove the rubber O-rings from O-ring adapters.

2. Remove screw at each end of piston assembly, then lift off O-ring adapters.

3. Note assembled position of reverser tee, springs, and reverser stops, then disassemble components.

4. Clean all parts thoroughly in alcohol, then examine for wear and abrasion. Replace parts if required. Grease rubber O-rings and gear rack liberally with S17 Lubricant.

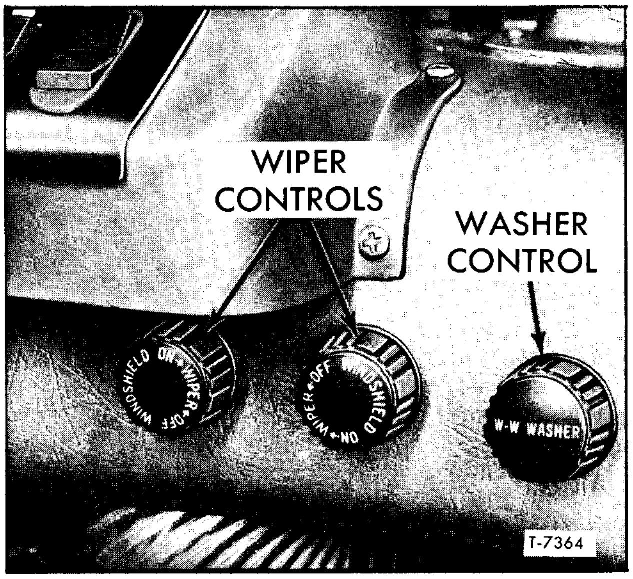


Figure 8—Windshield Wiper and Washer Control Knobs (Typical)

5. Referring to figure 5, assemble tee, springs, and reverser stops on reverser rod as shown. Position reverser rod on piston rack, then locate right and left O-ring adapters to piston rack and secure with screws. Tighten screws firmly. Install O-rings on adapters.

WINDSHIELD WASHER

The windshield washer system used on coaches covered by this supplement is air operated and controlled by a separate control valve knob, independent of the windshield wipers (fig. 8). The system automatically purges lines, both before and after spray cycle to positively eliminate possibility of frozen or clogged lines and nozzle. Each nozzle is adjustable in the spray tip to permit accurate direction of fluid to wiper area of windshield.

The control valve (fig. 9) permits short cycle spray when the control valve knob is pushed straight in. This will cause the following cycle; purge lines (3 seconds) spray (6½ seconds) purge lines (3 seconds) and then off. The control valve (fig. 9) also regulates air pressure at 35 to 50 psi.

If the control valve is pushed in and held, spray will continue until the diaphragm chamber (fig. 9), which holds 4½ ozs., is emptied. It takes approximately 6 seconds for the diaphragm chamber to refill.

The washer reservoir and diaphragm chamber assembly is located in the left front corner compartment of the coach (fig. 10). Reservoir has a screw-on type cover and has a capacity of 120 ounces. Air line from control valve (fig. 9) and liquid line to spray jet are in front compartment under coach windshield.

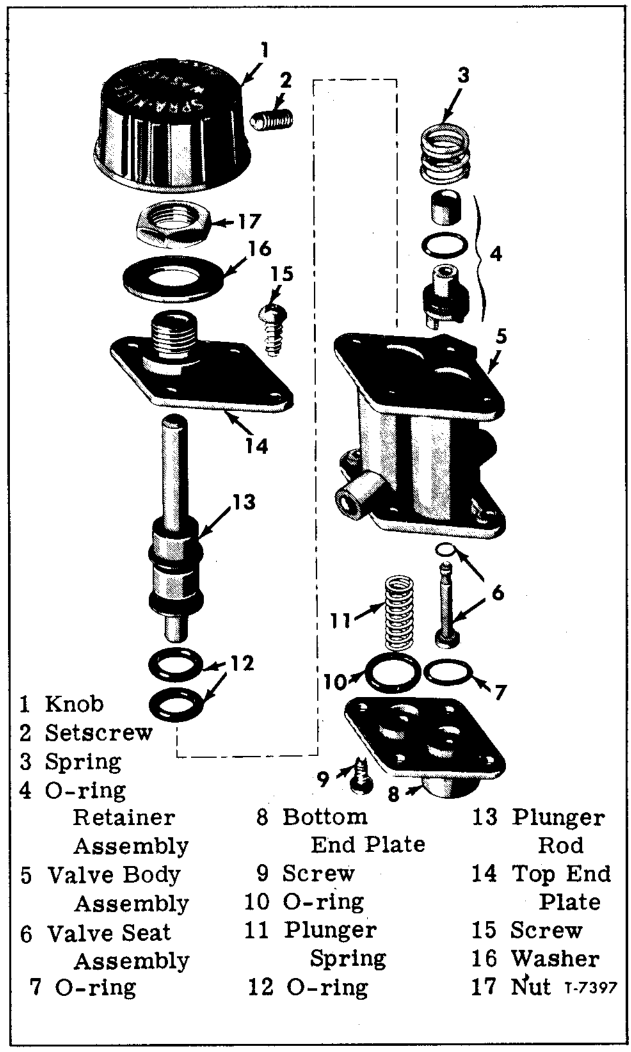


Figure 9—Windshield Washer Control Valve

REPLACEMENT OF CONTROL VALVE
(Refer to Fig. 9)

1. Exhaust air pressure from system.
2. Disconnect air lines.
3. Loosen setscrew and remove knob. Remove nut and washer from plunger rod. Remove valve assembly from dash panel.
4. Reverse procedure to install.

DISASSEMBLY OF CONTROL VALVE
(Refer to Fig. 9)

1. Remove top end plate.
2. Remove plunger rod assembly and remove O-rings.
3. Remove plunger rod spring from valve body assembly.

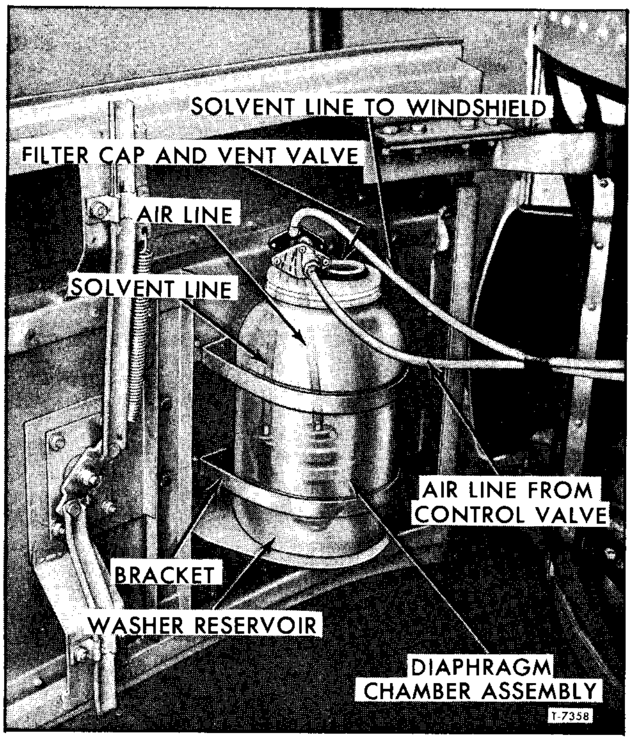

SOLVENT LINE TO WINDSHIELD
FILTER CAP AND VENT VALVE
AIR LINE
SOLVENT LINE
AIR LINE FROM CONTROL VALVE
BRACKET
WASHER RESERVOIR
DIAPHRAGM CHAMBER ASSEMBLY
T-7358

Figure 10—Windshield Washer Reservoir

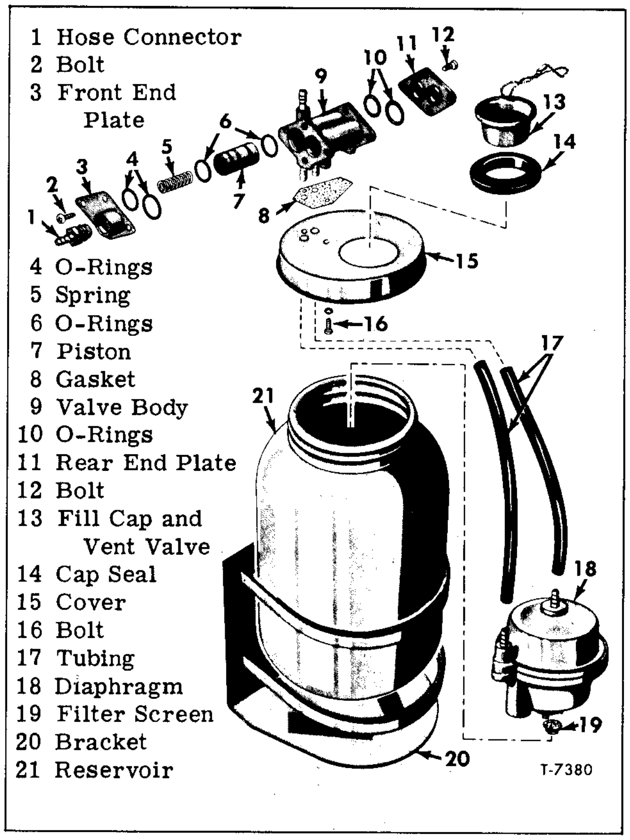
4. Remove O-ring retainer valve spring from valve body.
5. Remove bottom end plate.
6. Remove two O-rings from body.
7. Using a small flat end punch tap lightly to drive valve seat assembly out of O-ring retainer assembly. Remove O-ring retainer assembly. O-ring can be replaced if necessary.

CLEANING AND INSPECTION
OF CONTROL VALVE

Clean parts in alcohol and blow dry with compressed air. Replace damaged or worn parts and lubricate O-rings with S17 Lubricant as described in LUBRICATION (SEC. 13) of this supplement.

ASSEMBLY OF CONTROL VALVE
(Refer to Fig. 9)

1. Place O-ring retainer assembly with O-ring in place, in valve body assembly from the top. Place valve seat assembly in same chamber from the bottom. Hold retainer assembly against boss in valve body assembly and lightly tap valve seat assembly into place in retainer.
2. Install O-ring retainer valve spring in top of chamber.
3. Install new O-rings on plunger rod assembly.
4. Place plunger rod assembly in large chamber in valve body.



1	Hose Connector
2	Bolt
3	Front End Plate
4	O-Rings
5	Spring
6	O-Rings
7	Piston
8	Gasket
9	Valve Body
10	O-Rings
11	Rear End Plate
12	Bolt
13	Fill Cap and Vent Valve
14	Cap Seal
15	Cover
16	Bolt
17	Tubing
18	Diaphragm
19	Filter Screen
20	Bracket
21	Reservoir

Figure 11—Exploded View of Windshield Washer Assembly

5. Install plunger rod assembly in top end plate.
6. Install top end plate.
7. Install O-rings in bottom of chamber bores.
8. Install spring in chamber with plunger.
9. Install bottom end plate.

DISASSEMBLY OF WASHER COVER
AND VALVE ASSEMBLY (Fig. 11)

IMPORTANT: For correct assembly, mark or identify the four lines before disassembly.

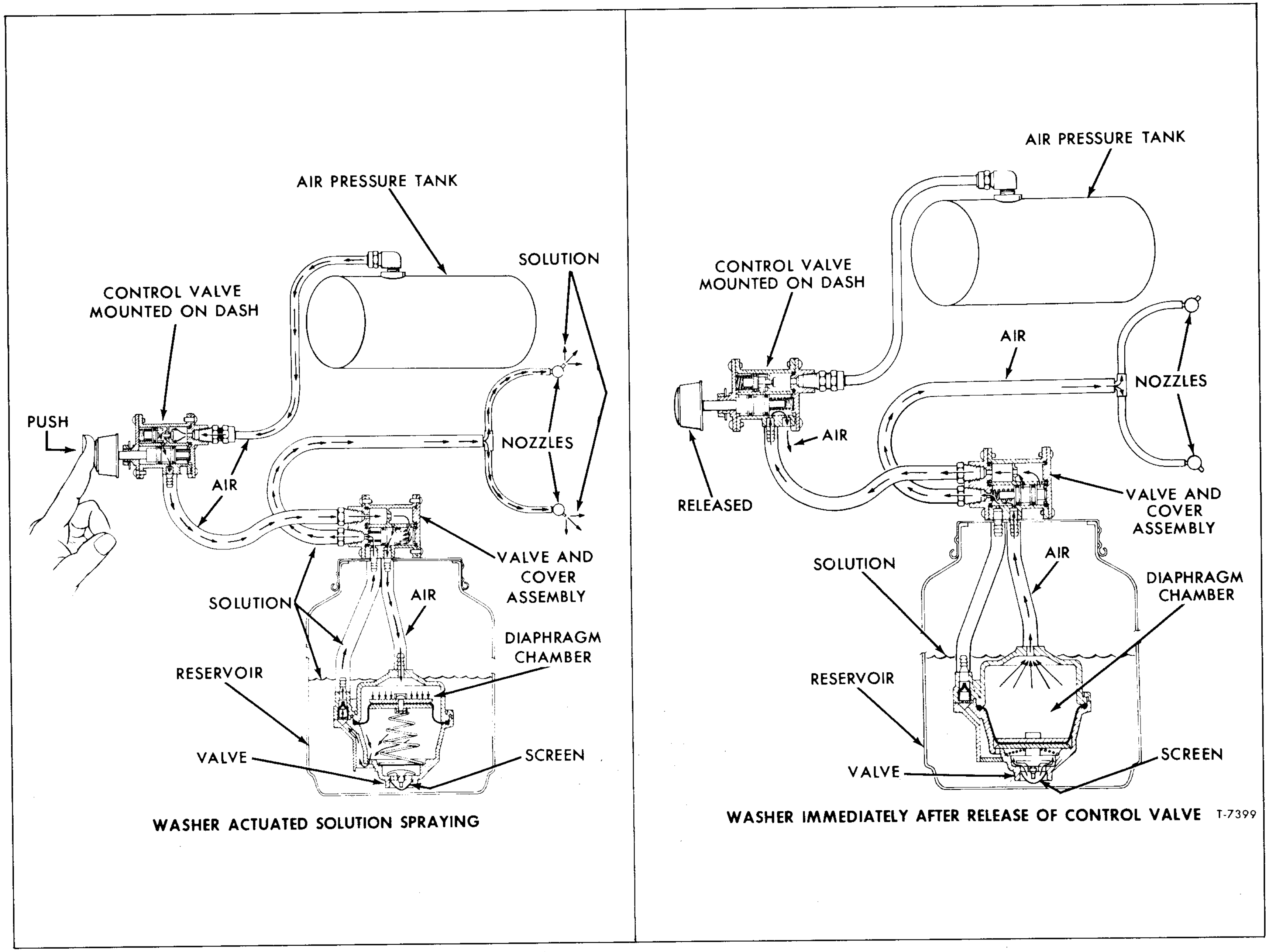
1. Remove the cover assembly from the reservoir and, if necessary, disconnect the four lines. Two from the reservoir cover to the diaphragm, and two to the valve body from the air supply line and to the washer nozzle.

2. Remove two screws attaching cover to valve body and remove valve body and gasket.

3. Remove screws attaching front and rear end plate to valve body. Remove end plates and O-rings.

NOTE: Hose connector can be removed from front end plate if necessary.

4. Remove spring and piston from bore in valve body. Remove O-rings from piston.



WASHER ACTUATED SOLUTION SPRAYING

WASHER IMMEDIATELY AFTER RELEASE OF CONTROL VALVE

Figure 12—Schematic Diagrams of Windshield Washer Operation

CLEANING AND INSPECTION

Wash and clean all parts in alcohol and blow dry with compressed air. Replace damaged or worn parts. Lubricate O-ring with S17 Lubricant as described in LUBRICATION (SEC. 13) of this supplement.

REASSEMBLY OF WASHER COVER AND VALVE ASSEMBLY

Reverse "Disassembly" procedures.

WASHER OPERATION

Refer to figure 12 for Schematic Diagrams of windshield washer operation.

SPECIFICATIONS

Windshield Wiper Air Motor	
GM Part No. (L.H. W/Bracket)	660223
(R.H. W/Bracket)	660227
Make	Sprague Devices Inc.
Model	M-520-1400
Sweeps per minutes (Wet Glass)	115 ± 5 Max.
Windshield Washer Air Control Valve	
GM Part No.	664400
Make	Sprague Devices Inc.
Model	GW-50
Windshield Washer Reservoir	
GM Part No.	664399
Make	Sprague Devices Inc.
Model	GW-71

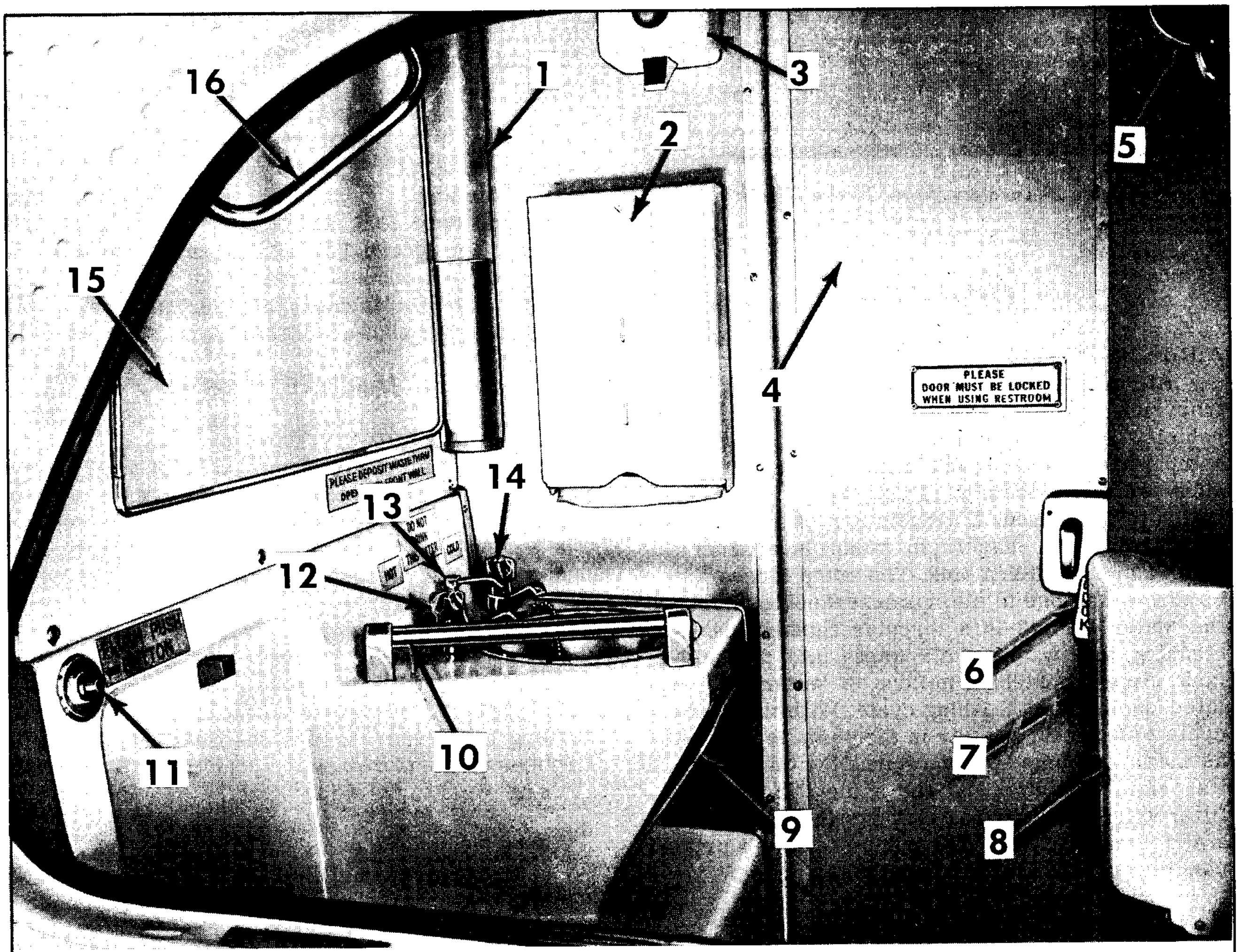
Lavatory

DESCRIPTION

Lavatory and toilet facilities (if so equipped) are identical for both models covered by this supplement. Lavatory (fig. 1) is located at right rear corner of coach. Lavatory compartment is equipped with wash basin, air flush toilet, liquid soap dispenser, mirror, waste paper container, toilet tissue dispenser, paper towel dispenser, and a sanitary napkin dispenser.

The air flush toilet is an assembly composed of a stainless steel bowl, 12-gallon holding tank, and a diaphragm pump located in the bottom of the holding tank. Also included, is a remote-mounted air flush button (fig. 1) and a pressure regulator valve. The pressure regulator valve is located in the compartment beneath the wash basin.

Wash basin waste water empties into the 23-gallon waste tank located directly below the lavatory compartment. The waste tank is emptied from beneath the coach, thus preventing odors from entering the coach.



1 Lamp
2 Towel Dispenser
3 Sanitary Napkin Dispenser
4 Compartment Door
5 Assist Handle
6 Door Lock
7 Waste Container
8 Toilet Tissue Dispenser
9 Service Access Door
10 Hand Rail
11 Flush Button
12 Hot Water Faucet
13 Soap Dispenser
14 Cold Water Faucet
15 Mirror
16 Assist Handle

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Figure 1—General Arrangement of Lavatory (Typical)

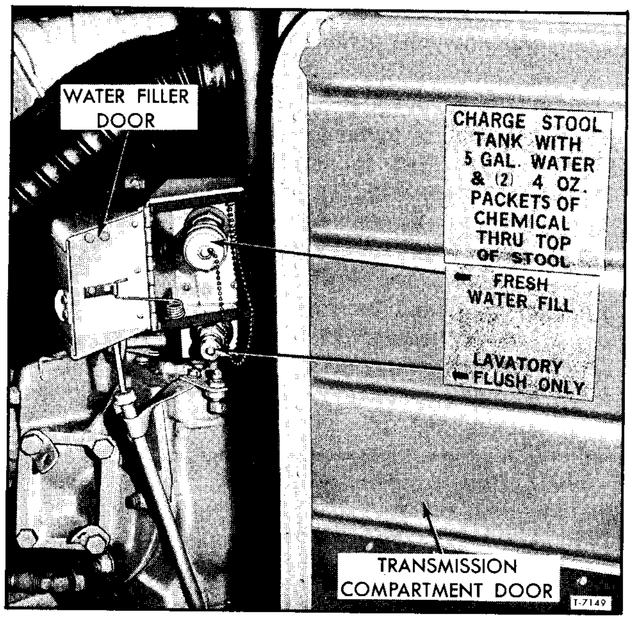

WATER FILLER DOOR
CHARGE STOOL TANK WITH 5 GAL. WATER & (2) 4 OZ. PACKETS OF CHEMICAL THRU TOP OF STOOL
← FRESH WATER FILL
LAVATORY ← FLUSH ONLY
TRANSMISSION COMPARTMENT DOOR
T-7149

Figure 2—Lavatory Water Service Fittings

OPERATION

AIR FLUSH TOILET

Air pressure for the air-operated toilet comes from the air line to the rear suspension of the vehicle. A pressure regulator valve located in compartment below wash basin reduces the pressure to toilet system to 10 psi. When the air-flush button is depressed, 1/3-cubic foot of air at 10 psi is delivered to diaphragm pump located at the bottom of the holding tank. The pump forces water up through a hose to the stainless steel bowl. There the water travels in a circular flushing pattern, cleaning and washing all waste into the holding tank. Approximately 2 gallons of water is circulated during each flushing cycle. With the flushing cycle completed, the air in the pump is exhausted as the large pump spring returns the diaphragm to its original position. At the same time, water is filtered from the holding tank into the pump through a self-cleaning filter. The pump is now in a primed condition, ready for the next flushing cycle.

LAVATORY EMERGENCY BUZZER

The lavatory emergency buzzer is mounted on panel under dash in front of driver. Buzzer is operated by a push button type switch, marked "TO SIGNAL DRIVER - EMERGENCY ONLY," located on toilet compartment front wall. To check circuit continuity, refer to "Lavatory Wiring Diagram" in "Wiring Diagrams" booklet X-7014A. If buzzer or push button switch becomes defective, they must be replaced.

LAVATORY SIGN LIGHT

Lavatory sign light, located on the front wall of the lavatory compartment, is illuminated when lavatory is occupied, door closed, and locked. Sign reads "REST ROOM - OCCUPIED." To check circuit continuity, refer to "Lavatory Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

LAVATORY COMPARTMENT LAMP

A fluorescent lamp is mounted on rear wall, beside mirror (fig. 1) in lavatory compartment. This lamp is illuminated when the engine control switch is in the "ENG." position with the lavatory door either open or closed. When the door is closed and locked the lamp is energized from the battery. Refer to ELECTRICAL SYSTEM (SEC. 7) of this supplement for circuit description. To check circuit continuity, refer to "Lavatory Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

LAVATORY DOOR LOCK AND
DOOR LOCK SWITCH

Information pertaining to the lavatory door lock and door lock switch is the same as found in Maintenance Manual X-6814, page 51. Note the lavatory door on models covered by this supplement swings into the lavatory compartment, which differs from that shown in Maintenance Manual X-6814.

MAINTENANCE

WASH BASIN SUPPLY TANK

The lavatory is equipped with a 10½-gallon fresh water tank which supplies wash water to the wash basin by gravity feed. The polyethylene tank is equipped with two fittings at the top of the tank, of which one is connected to the fresh water fill fitting (see fig. 2) and the other top tank fitting allows air to enter the tank through a check valve as water is displaced from the tank. The overflow fitting located on the side of the tank allows air and water to be exhausted from tank, during the filling operation, through the overflow line and a rubber trap underneath the coach. The bottom tank fitting leads to the wash basin.

Filling Supply Tank

1. Open water filler door at right rear of coach (fig. 2), then connect water supply hose to fresh water fill fitting.

2. Fill supply tank with CLEAN fresh water until water starts to flow out overflow line (under the coach).

3. After filling tank, disconnect water supply hose, then close filler door.

Draining Supply Tank

1. In the lavatory compartment, open service compartment access door (fig. 1). Then open the

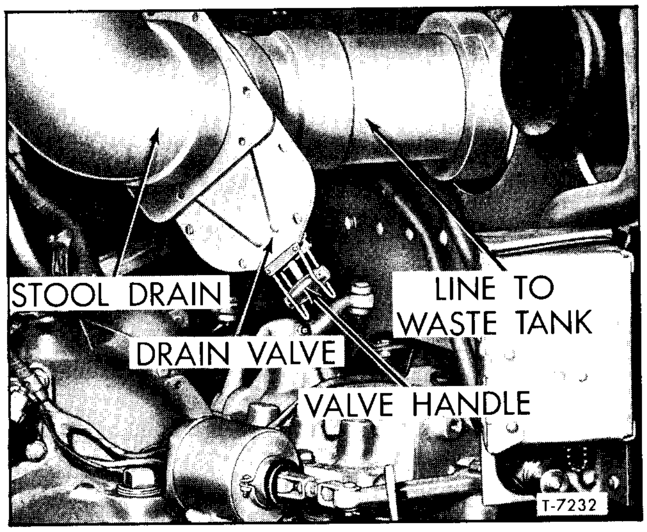


Figure 3—Holding Tank Drain Valve

supply tank drain valve located under the wash basin, which allows water to drain from supply tank into the overflow line.

2. If supply tank is to be flushed out, leave valve open and flush out tank, using same procedure as for filling supply tank described previously.

3. After either draining or flushing of tank close valve.

WASH BASIN SUPPLY LINE CHECK VALVE

Information pertaining to the wash basin supply line check valve is the same as described in Maintenance Manual X-6814, page 56.

AIR FLUSH TOILET

Charging Toilet

NOTE: Before charging toilet, be sure holding tank drain valve (fig. 3) is closed.

1. To prevent under- or over-charging, add five gallons of fresh water directly through the stool.

NOTE: A toilet compartment access door (fig. 4) located on lavatory window is provided so a hose may be extended into the lavatory compartment to facilitate charging the toilet.

2. Add two 4-oz. packets of chemical directly into the bowl and press the flush button to mix solution and check flushing operation.

Draining Toilet Holding Tank

The toilet holding tank should be drained whenever filled.

1. To drain toilet holding tank, open holding tank drain valve (fig. 3), located above transmission, in the engine compartment.

2. Close the holding tank drain valve when tank is empty.

3. Recharge toilet as described previously.

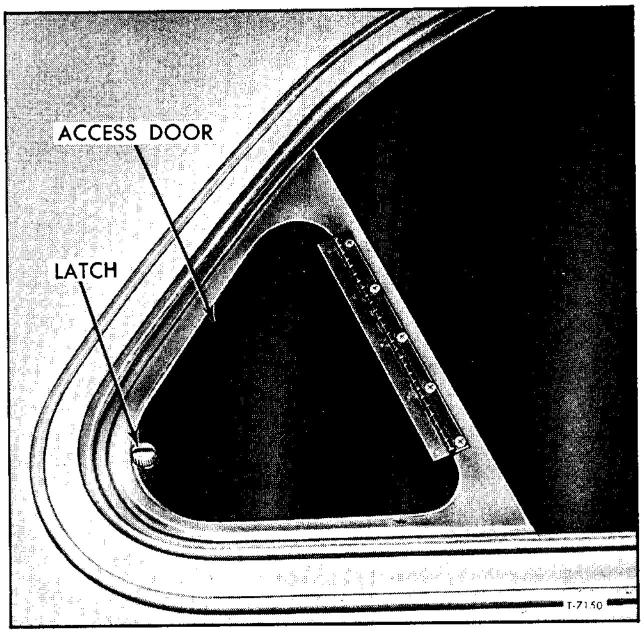


Figure 4—Lavatory Compartment Service Access Door

LAVATORY WASTE TANK

The waste tank has a 23-gallon capacity which is enough to accept one wash basin tank fill (10½ gallons) and one full holding tank (12 gallons). Since the wash basin supply tank dumps directly into the waste tank, do not dump more than one 12-gallon holding tank fill into the waste tank, because there would not be sufficient capacity left in the waste tank to allow drainage of the wash basin during continued use.

Draining Waste Tank

The tank must be dumped only at an approved sanitary dumping station. Connections for draining the tank into a sewer are shown in Maintenance Manual X-6814, page 53.

1. When the coach has been properly positioned and connected to dumping receptacle, open the waste tank drain valve (fig. 5). The valve must be held in the open position while draining tank, as it is spring-loaded.

2. Connect a water hose to the lavatory flush fitting (fig. 2) located at right rear of coach. This connection sprays water into the toilet holding tank. Turn on water supply.

3. When water level in holding tank reaches bottom of bowl, open the holding tank drain valve (fig. 3), and continue flushing for a minimum of one minute while the holding tank empties.

4. Shut off water supply to flush fitting of holding tank.

5. Periodically, inspect holding tank after flushing for accumulation of refuse. This may be done by extending a long-handled mirror through

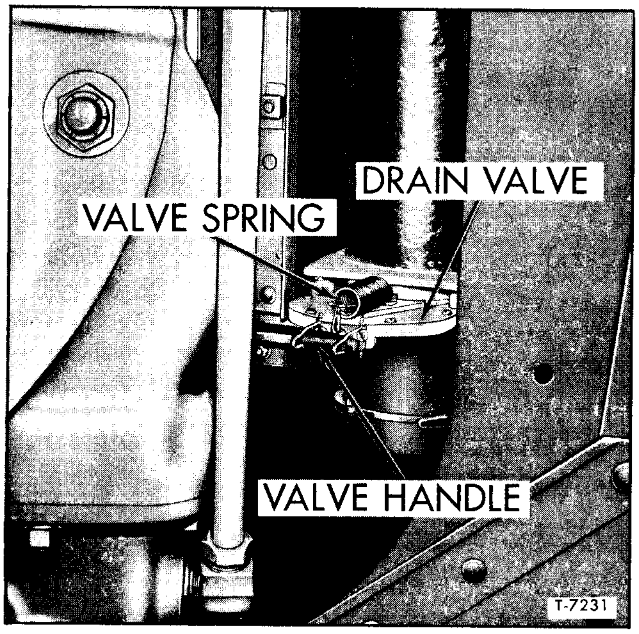


Figure 5—Waste Tank Drain Valve

the bowl opening and directing a flashlight beam into the holding tank. If accumulation of refuse is present, it may be necessary to spray a hose directly into stool opening.

A stainless steel rod is suspended from the top of the tank to a point over the center of the drain tube. The purpose of this rod is to prevent large solid objects from entering the drain tube and plugging it. DO NOT BEND OR MOVE THIS ROD. Remove objects too large to enter drain by lifting them out through the top opening of toilet.

NOTE: A toilet compartment access door (fig. 4) located on lavatory window is provided so a hose may be extended into the lavatory compartment to facilitate removal of accumulation in holding tank.

6. When flushing operation is complete disconnect hose from flush fitting (fig. 2). Be sure both holding tank and waste tank are empty. Close the holding tank drain valve (fig. 3) and the spring-loaded waste tank drain valve (fig. 5).

7. Recharge toilet as described previously.

WINTERIZING TOILET SYSTEM

Whenever temperatures below freezing are anticipated, the original five-gallon charge for the holding tank should include an Ethylene Glycol base automotive anti-freeze. DO NOT USE STRAIGHT ETHYLENE GLYCOL because of its foaming characteristics. Automotive anti-freeze contains foam inhibitors. DO NOT PRE-MIX ANTI-FREEZE AND FLUSHING SOLUTION FOR STORAGE because the deodorizing chemical will deteriorate the anti-foaming agent after two weeks.

Charging solution should be mixed as follows:

Per Cent Anti-Freeze	Protects To
25	+10°F.
33	0°F.
40	-12°F.
50	-34°F.

WATER HEATER

A water heater, available as special equipment, heats water for the wash basin. The heater is located in the compartment below the wash basin and is energized (heating) whenever the engine control switch is in the "ENG." position.

If the water heater should become defective, it must be replaced by performing the following:

Water Heater Replacement

1. Place battery disconnect switch in the "OFF" position. Note, switch is located in the battery compartment.
2. Open the service access door (fig. 1) in the lavatory compartment.
3. Open the wash basin supply tank drain valve. When tank has been drained, close valve.
4. Disconnect the two water heater wires at terminal junctions.
5. Remove inlet and outlet plumbing fittings from water heater.
6. Remove mounting straps retaining water heater in service compartment.
7. Remove defective unit and replace with new water heater.
8. Connect inlet and outlet plumbing fittings and install two retaining straps.
9. Refill wash basin supply tank and check water heater fittings for leaks. Correct as necessary.
10. Reconnect water heater wiring.
11. Place battery disconnect switch in "ON" position.
12. With engine control switch in the "ENG." position, check water heater for proper operation, by opening and closing wash basin "HOT" water faucet.

WASH BASIN WATER FAUCETS

Water faucets used in coaches covered by this supplement are the same as described in Maintenance Manual X-6814, page 56.

SPECIFICATIONS

AIR FLUSH TOILET	
Make	Monogram Industries, Inc.
Model	12900-001
GM Part Number	675562
Holding Tank Capacity	12 Gal.
Water Required for Charging	5 Gal.
WASH BASIN SUPPLY TANK	
Capacity	10.5 Gal.
LAVATORY WASTE TANK	
Capacity	23 Gal.
WATER HEATER	
Make	Phillips Mfg. Co.
Model	13502
GM Part Number	662762
Volts	24

IMPORTANT

If vehicle is stored when temperatures are below freezing, be sure toilet system is winterized as described earlier in this section.

SECTION 4

Brakes

All information in Maintenance Manual X-6814, BRAKES (SEC. 4), starting on page 59 applies to vehicles covered by this Maintenance Manual Supplement except as specifically stated below:

PREVENTIVE MAINTENANCE CHART

The vehicles covered by this Maintenance Manual Supplement are used in different types of operation. With these conditions, it is impossible to establish the maintenance intervals (either time or mileage). Therefore, any such intervals given in the following Maintenance Chart must be related to the type of operation in which a particular vehicle is used. Intervals given are manufacturer's recommendations and should be considered as maximum periods. Maintenance operations at shorter intervals are preferable to longer intervals.

Whenever any assembly is removed and disassembled for maintenance it is advisable to replace all grommets, gaskets, O-rings etc., and any other parts which show wear or deterioration.

PREVENTIVE MAINTENANCE CHART

ITEM	INTERVAL (1)	MAINTENANCE OPERATION
Check Valves	6 Mos.-50,000 Miles-1800 Hrs.	Remove, disassemble, clean, inspect
Air Tank Check Valve	6 Mos.-50,000 Miles-1800 Hrs.	Remove, disassemble, clean, inspect
Low Air Pressure Switch	300 Hrs. - 8,000 Miles	Check Electrical Connections
	3,600 Hrs. - 100,000 Miles	Remove, disassemble, clean, inspect
Safety Valve	Annually	Remove, disassemble, clean, inspect
Air Lines	5,000 Miles	Test for leaks; tighten as necessary
Moisture Ejector Valve	1800 Hrs-50,000 Miles-6Mos.	Remove, disassemble, clean, inspect
Alcohol Evaporator	10,000 Miles - 2 Months	Remove and clean strainer
	50,000 Miles - 1 Year	Remove, disassemble, clean, inspect
Brake Shoe Assemblies	(2)	Check lining thickness (5/16" or less, reline)
Slack Adjuster	3,000 Miles	Lubricate at chassis lubrication interval
Std. Brake Chamber	3,600 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect
DD3 Brake Chamber	3,600 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect
Application Valve	300 Hrs-8,000 Miles-30 Days	Lubricate treadle pin and roller pin
	3,600 Hrs. - 100,000 Miles-1 yr	Remove, disassemble, clean, inspect
Relay Valve	3,600 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect
Inversion Valve	3,600 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect
Push-Pull Valve	3,600 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect
Limiting-Quick Release Valve	Annually	Remove, disassemble, clean, inspect
Air Compressor	(2)	Clean carbon from valves and discharge line. Check mounting bolts and tighten. Check lines for leaks.
Governor	500 Hrs - 15,000 Miles	Clean or replace filters.
	3000 Hrs. - 100,000 Miles-1 yr.	Remove, disassemble, clean, inspect, re-set

(1) Where more than one interval is given, operation to be performed at time of whichever occurs first.
(2) Determined by severity of service.

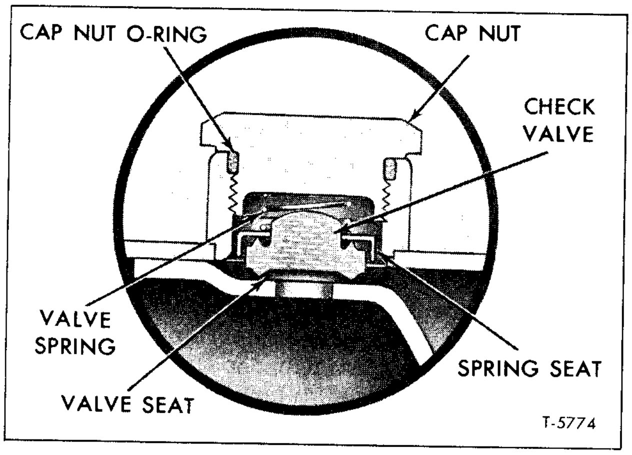


Figure 1—Air Tank Check Valve

AIR TANK CHECK VALVE

The check valve is built into the air tank at the point where the tank is divided (fig. 1). This type check valve is a spring-loaded valve and functions the same as other one-way check valves. The valve is accessible by removing the valve cap from the air tank. Use caution when removing cap as valve is spring-loaded. Replace any parts which appear corroded or deteriorated.

DIVIDED TANK CHECK VALVE SERVICE
(Refer to Fig. 1)

1. Release pressure from all reservoirs.
2. Remove cap nut carefully. Nut compresses valve spring and parts will actually "fly off" if not removed carefully.
3. Remove spring, spring seat, and valve.
4. Inspect all parts for cracking, deterioration, or swollen condition. Discard any bad parts.
5. Clean valve seat area.
6. Reassemble, using new parts as necessary. Install valve, spring seat, and spring.
7. Compress spring by pushing down on cap nut and thread cap nut into tank. Tighten cap nut.
8. Build up air pressure in system and determine effectiveness of check valve by opening drain cock on "wet" portion of tank and note pressure retention in "dry" portion of tank.

R-6 RELAY VALVE

The R-6 Relay Valve is piston actuated, rather than diaphragm actuated and exhausts with each brake application for maximum possible moisture ejection. The valve is used on all coaches covered by this supplement.

Once each year, every 3600 hours, or every 100,000 miles, the valve should be removed from the coach, disassembled, and cleaned. All rubber parts and parts subject to wear should be inspected and replaced if found to be worn, damaged, or swollen. Operating and leakage tests should be performed each time the brakes are adjusted.

A port has been provided in the top of the valve cover of the R-6 relay valve to enable moisture to be ejected, thereby preventing corrosion and freezing of the valve.

The servicing of the valve should be done periodically, dependent upon operating environment. Block and hold the coach by means other than the air brakes. Remove the plug from the service port. Make several brake applications to ensure that all moisture is ejected. Re-install plug in service port.

OPERATING TEST

1. Run the engine to fully charge the air brake system and then adjust the brakes.
2. Make several brake valve applications and check for prompt application and release of brakes at all wheels.
3. If the valve does not function as described, the valve should be rebuilt or replaced.

LEAKAGE TEST

1. With the air system fully charged and the brake valve in the released position, check the exhaust port with a soap and water solution for excessive leakage. Leakage in excess of a one-inch bubble in one second is not permissible. Leakage in this test indicates a leaking inlet valve or valve guide O-ring.
2. Make and hold a brake valve application and check exhaust port for leakage. If excessive leakage is detected, the insert or the exhaust valve only should be replaced. If leakage still occurs at the exhaust after the exhaust valve is replaced, then leakage could be at the relay piston O-ring or possibly at the exhaust valve seat. Continue to hold application and check between cover and body for cover O-ring leakage.
3. If leakage is excessive, the valve should be rebuilt or replaced.

REMOVING R-6 INSERT OR VALVE

1. Block and hold the coach by means other than the air brakes.
2. Drain air from all brake reservoir supply tanks.
3. The inlet and exhaust valve assembly, generally referred to as the R-6 insert (see fig. 2) can easily be removed and serviced or replaced. Just remove the two exhaust cover cap screws and cover itself, then pull the insert out. Normally the insert can be removed without disturbing the valve mounting or connecting lines. Always remember: DRAIN RESERVOIR SUPPLY BEFORE ATTEMPTING TO REMOVE INSERT.

If further disassembly is necessary, label,

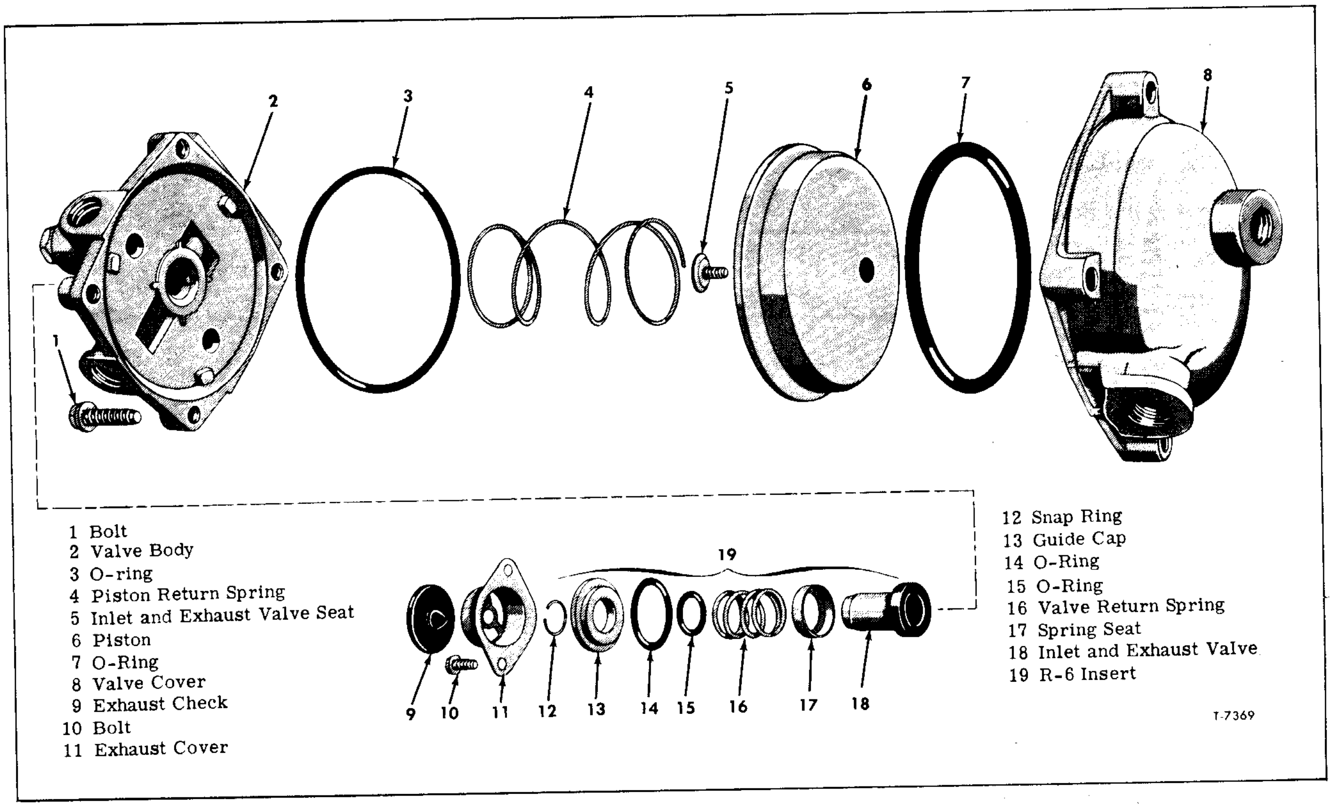


Figure 2—R-6 Relay Valve

remove, and cap all air lines from the R-6 relay valve before removing the valve mounting bolts.

DISASSEMBLY (Refer to Fig. 2)

1. Scribe marks on cover and valve body to permit proper reassembly. Remove four bolts which fasten cover to valve body.
2. Remove cover. Piston will remain inside cover. Remove piston return spring.
3. Remove piston and O-ring from cover. Use air pressure if necessary.
4. Remove O-ring from piston.
5. Remove inlet and exhaust valve seat.
6. Remove O-ring from valve body.
7. Remove two bolts which fasten exhaust cover to valve body.
8. Remove exhaust cover and remove exhaust check from cover.
9. Press inlet and exhaust valve assembly out of valve body.
10. Disassemble inlet and exhaust valve:
    a. Remove snap ring and separate valve guide cap return spring and spring seat from valve.
    b. Remove O-rings from valve guide cap.

INSPECTION (Refer to Fig. 2)

1. Thoroughly clean all parts in a suitable cleaning fluid.
2. Discard all O-rings.
3. Examine interior bores of valve body inside of valve cover for scratches and pits. If only slightly scratched or pitted, the surfaces can be polished. Replace with new parts if damage is excessive.
4. Examine valve and seat for evidence of wear, deterioration, cracks, and scratches.
5. Examine valve spring and piston spring. Compare height and tension with new springs. Replace if not comparable.
6. Examine exhaust check and discard if worn, cracked, or deteriorated.

ASSEMBLY (Refer to Fig. 2)

1. Install O-rings in valve cap.
2. Assemble inlet and exhaust valve. Install spring seat, return spring and valve cap on valve and secure with snap ring.
3. Press inlet and exhaust valve in valve body.
4. Install exhaust check in exhaust cover and install cover on valve body.
5. Install new O-ring in valve body.
6. Install valve seat in piston.
7. Install new O-ring on piston.
8. Install piston assembly in cover.
9. Place piston return spring in valve body.
10. Place piston and cover assembly in valve body (align marks made at disassembly), compress return spring and secure cover to body with four bolts.

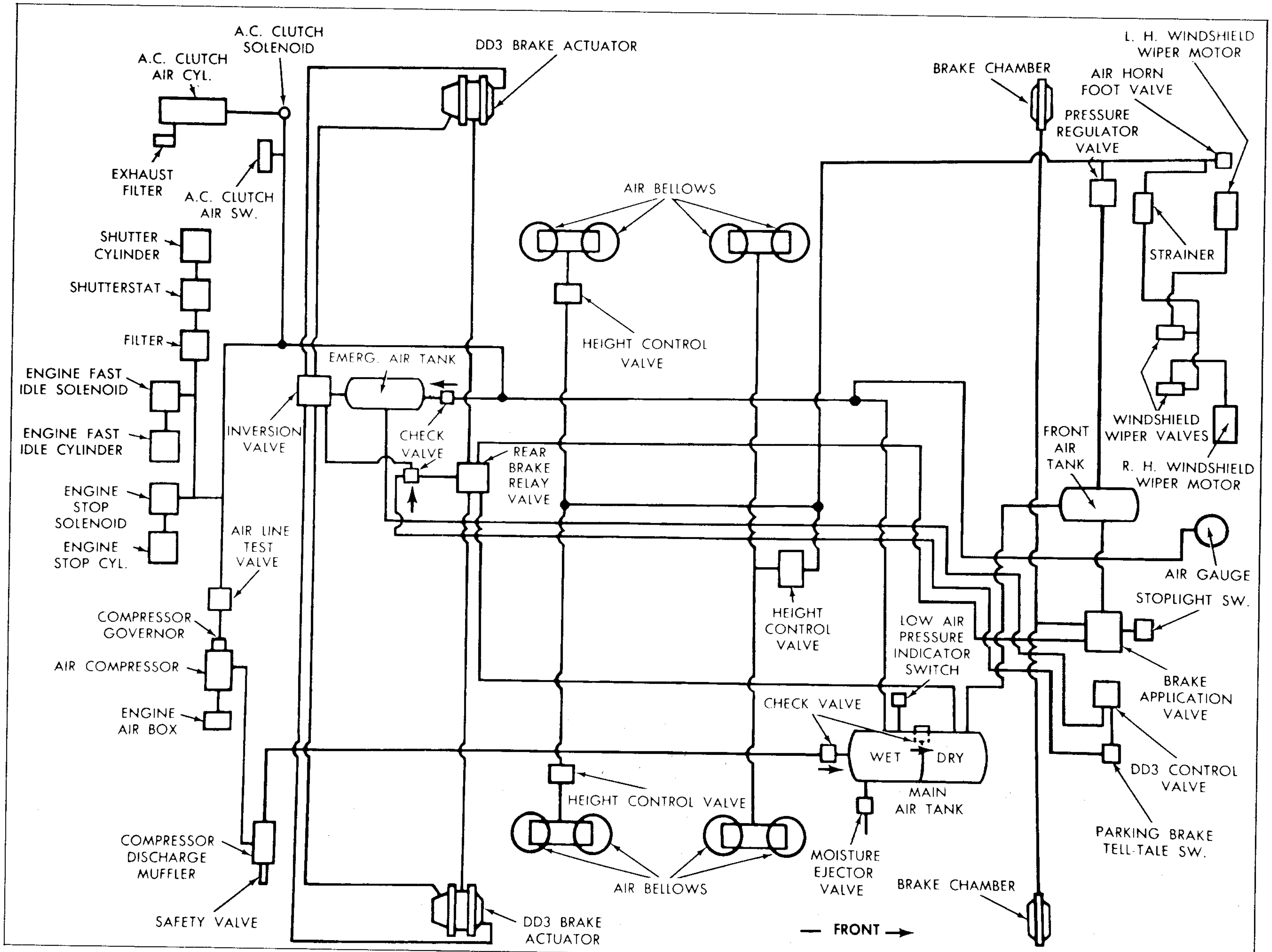


Figure 3—Schematic Air Line Diagram (Typical)

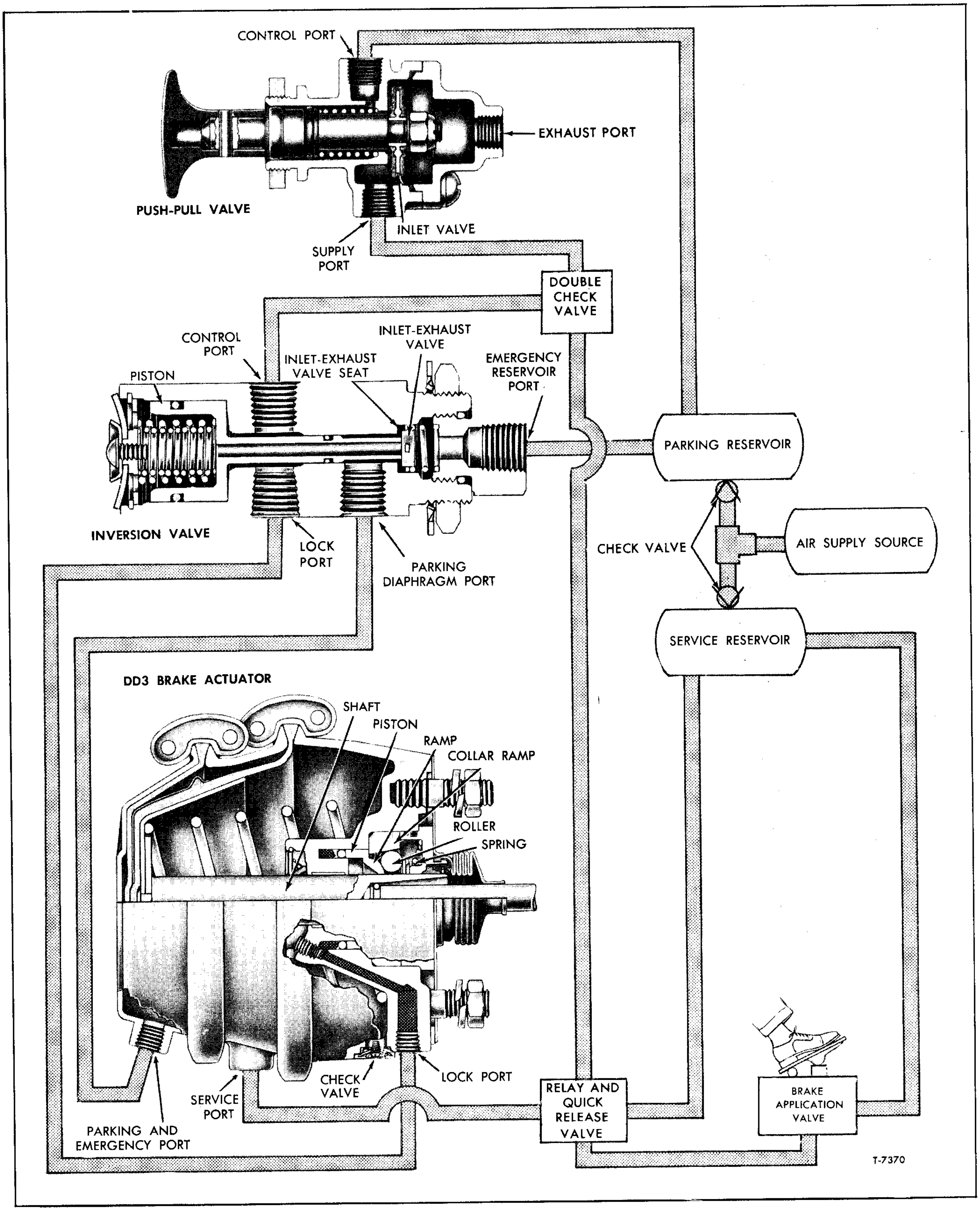
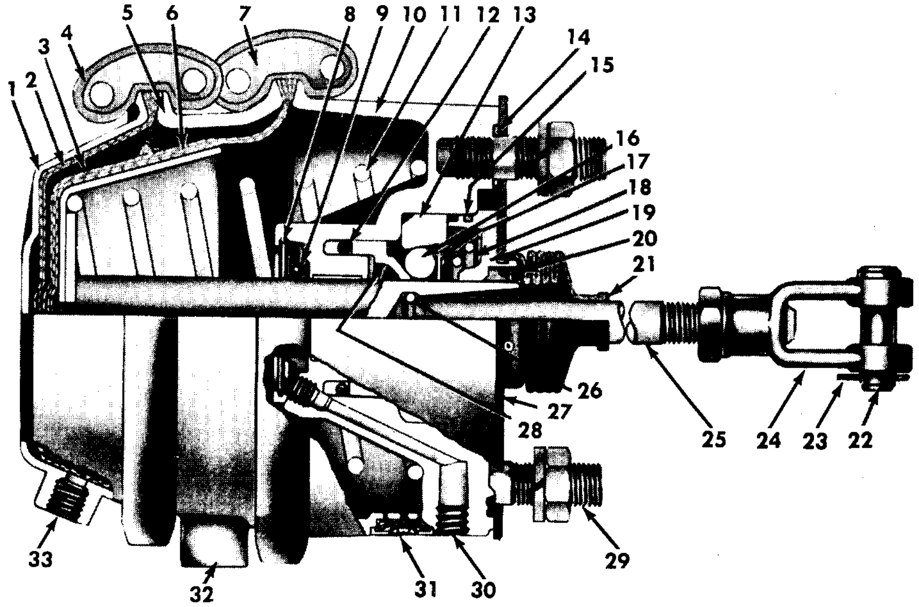


Figure 4—Schematic Diagram of DD3 Brake Actuator System



1 Auxiliary Pressure Plate
2 Auxiliary Diaphragm
3 Diaphragm Separator
4 Auxiliary Clamp Ring
5 Service Pressure Plate
6 Service Diaphragm
7 Service Clamp Ring
8 Rear Seal Retainer
9 Rear Seal
10 Non-Pressure Plate
11 Return Spring
12 Piston Grommet
13 Collar
14 Gasket
15 Cap O-Ring
16 Roller
17 Spring Seat Washer
18 Roller Spring
19 Lock Cap
20 Front Seal
21 Boot
22 Clevis Pin
23 Cotter Pin
24 Clevis
25 Push Rod
26 Retainer Ring
27 Splash Plate
28 Piston
29 Stud
30 Lock Port
31 Check Valve
32 Service Port
33 Parking and Emergency Port

T-7017

Figure 5—DD3 Brake Actuator

INSTALLING R-6 VALVE OR INSERT

Clean and inspect relay valve connecting air lines. Replace lines which are damaged or connecting hoses which are deteriorating or show signs of chafing. Mount relay valve securely. Connect air lines to valve. Test valve for serviceability and air line connections for leakage.

A new or rebuilt R-6 insert is simple to install but caution should be used against nicking of the inlet and exhaust valve or guide O-ring. After the insert is properly placed in its bore in the body, install the exhaust cover with exhaust check and hold in place while tightening the two cover cap screws. After installation has been completed, perform operating and leakage tests.

DD3 BRAKE SYSTEM

Two basic changes have been made to the DD3 brake system as described in Maintenance Manual X-6814.

The piping has been changed to remove the line from the application valve to the control valve and a check valve has been added to the system between the relay valve and the inversion valve. The line from the control valve is routed through this check valve to the inversion valve. Refer to figure 3 for complete air line diagram and figure 4 for schematic diagram of DD3 Brake Actuator System.

The second basic change is the use of a different control valve.

There has also been a change in the DD3 brake actuator.

DD3 BRAKE ACTUATOR

The operating principle of the DD3 actuator remains the same as those used on previous model coaches, but certain changes and refinements have been made. The following parts have been added to the assembly (refer to fig. 5):

Diaphragm Separator (3)
Rear Seal Retainer (8)
Rear Seal (9)
Gasket (14)
Cap O-ring (15)
Front Seal (20)
Check Valve (31)

The following part has been removed:
Clevis Lock Nut

The following parts have been changed:
Splash Plate (27)
Mounting Bolt (29)

These revisions result in a change in overhaul procedures.

DD3 BRAKE ACTUATOR OVERHAUL

DISASSEMBLY (Refer to Fig. 5)

1. Clean brake actuator exterior of all road grime. Mark it in such a way that it can be reassembled correctly.
2. Remove clevis and lock nut.
3. Remove splash plate, boot, and gasket.
4. Remove auxiliary and service clamping ring nuts and bolts. Spread clamping rings slightly, just enough to slip them off the plates. It may be necessary to use a soft mallet driver to break the clamping rings loose. If the rings are being re-used, caution should be taken against bending them out of shape.
5. After clamping rings are removed, auxiliary pressure plate, auxiliary diaphragm, service pressure plate and service diaphragm are removed in that order. Remove diaphragm separator from service diaphragm.
6. Place the remains of actuator on a smooth surface with the push plate down. Connect an air supply (shop air) line to the locking port. By hand press down on the actuator non-pressure plate and at the same time apply air to the locking port. As the shaft is unlocked, ease the non-pressure plate back and remove push plate and shaft assembly with push rod and return spring.
7. Hold lock cap down against roller spring tension and completely remove all four cap screws before releasing and removing cap. Remove front seal from lock cap if seal is worn or damaged. Remove cap O-ring.
8. Remove the roller spring and spring seat washer.
9. Remove all eight rollers.
10. Next, cautiously apply air at the locking port to assist in removal of collar and piston, and to remove piston grommet.
11. Inspect bearing in shaft bore of non-pressure plate and remove it only if it is showing signs of wear and is to be replaced.
12. Remove rear seal and retainer from non-pressure plate if seal is worn or damaged.
13. The push rod should not be removed from the shaft unless it is damaged. If the rod is removed it must be replaced. To remove the rod, place a heavy washer over the rod against the shaft, then position a spacer and second washer over the rod and beneath the yoke adjusting nut. Turn the adjusting nut down with a long handled wrench, pulling the push rod from the shaft.
14. The mounting studs in the non-pressure plate can be removed and replaced if damaged.
15. Remove check valve from non-pressure plate.

CLEANING AND INSPECTION

Wash all metal parts in a good cleaning solvent. Dry thoroughly. Any re-usable rubber parts should be wiped clean. Inspect all parts for excessive wear or deterioration. Particular attention should be given to the piston and collar bores in the plate. Also, the air passage from the lock port to piston bore should be clean and not restricted. It may be necessary to remove the inspection plug to thoroughly clean this passage.

Rollers should be checked carefully and all replaced if one or more need replacing. Check springs for cracks, distortion, or corrosion.

Replace all parts not considered serviceable during these inspections, especially rubber parts.

ASSEMBLY (Fig. 5)

1. On assembly, line up parts as they were marked prior to disassembly.
2. If the bearing in the non-pressure plate was removed it should be re-installed or replaced.
3. Lubricate piston and collar bores, shaft, piston grommet, piston and roller cavity with a barium base lubricant.
4. Install rear seal, rear seal retainer, and check valve in non-pressure plate.
5. Position piston grommet in piston bore. Then place piston, with smooth end down, against grommet.
6. Place collar in its bore in plate.
7. Position all eight rollers in groove formed by top of piston and collar ramp.
8. Place roller spring seat washer on top of rollers.
9. Position cone-shaped roller spring on the washer with small end to washer.
10. Install O-ring and front seal in lock cap. Position cap on roller spring. Press cap down and hold while installing the cap screws evenly and securely.
11. Turn over non-pressure plate with lock mechanism installed and position return spring in plate with large end down.
12. Position push plate and shaft and push rod assembly over return spring and press down so

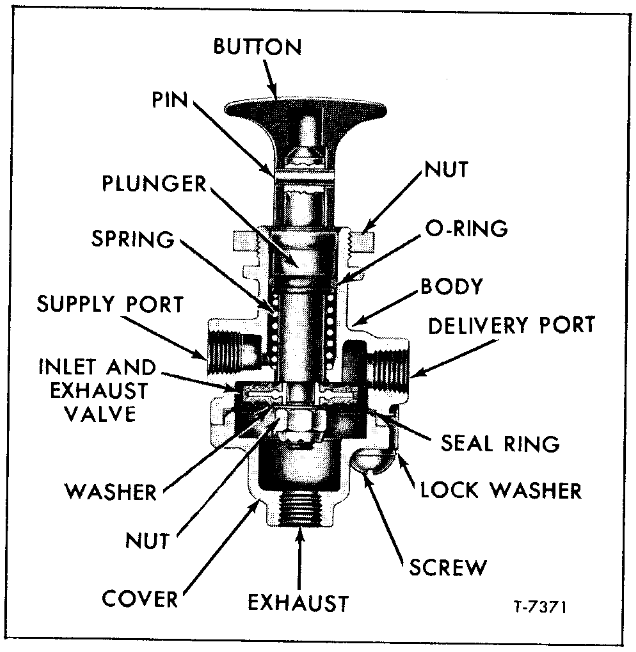


Figure 6—Push-Pull Control Valve

shaft moves through lock. The lock should hold shaft position against return spring. If not, check assembly to this point.

13. Install service diaphragm and diaphragm separator assembly, service pressure plate and clamping ring.
14. Install the auxiliary diaphragm, auxiliary pressure plate and clamping ring.
15. Tighten clamping ring bolts in both clamping rings evenly and securely.
16. Install boot and splash plate gasket, then install splash plate down over boot.
17. Install clevis and lock nut.
18. Install mounting studs.

PUSH-PULL CONTROL VALVE

(Refer to Figure 6)

REMOVAL

1. Secure vehicle by some means other than air brakes.
2. Exhaust air from parking brake system. It is unnecessary to exhaust service air.
3. Disconnect air lines from push-pull control valve. Mark lines to assure installation in correct valve ports when replacing valve.
4. Drive spirol pin out of button and remove button.
5. Remove mounting nut from valve body and remove valve from mounting bracket.

DISASSEMBLY

1. Remove the two cover screws and separate the cover from the body.
2. Remove sealing ring from body.
3. Insert a rod or punch in the plunger pin hole to keep plunger from turning while removing nut and washer at bottom of valve.
4. Remove plunger and spring from valve body.
5. Remove plunger O-ring.
6. Remove inlet and exhaust valve from body.

CLEANING AND INSPECTION

Wash all metal parts in a good cleaning solvent. Dry thoroughly. Wipe re-usable rubber parts clean. Inspect all parts for excessive wear or deterioration. Inspect plunger and piston bores for nicks and burrs. Check spring for cracks, distortion and corrosion. Inspect the inlet and exhaust valve, sealing ring, and O-ring for wear or deterioration.

Replace all parts not considered serviceable, especially rubber parts.

ASSEMBLY

1. Install O-ring on plunger.
2. Install sealing ring in body.
3. Insert spring and plunger in valve body.
4. Install inlet and exhaust valve on end of plunger in valve body.
5. Insert a rod or punch in the plunger pin hole to keep plunger from turning. Install washer and nut on threaded end of plunger in valve body. Torque nut to 30 to 40 inch-pounds.
6. Install cover and secure with two cover screws.

INSTALLATION

1. Position valve on mounting bracket and secure with mounting nut.
2. Place button on plunger shaft, line up hole in button with hole in plunger shaft and drive in spirol pin.
3. Connect air lines to push-pull control valve ports making sure lines are connected to correct ports.
4. Build up vehicle air pressure system, and check valve for operation and leaks.

See Next Page For "Specifications."

BRAKE SPECIFICATIONS

Specifications in Maintenance Manual X6814 also apply to vehicles covered by this supplement except:

Brake Size	PD-4108	PD-4905
Rear Brakes	14½″ x 8″	14½″ x 10″
Brake Lining (Rear)		
Width	8″	10″
Effective Brake Area	470 sq. in.	588 sq. in.
Slack Adjuster (Front)		
Length between Hole Centers	5¼″	5¾″

SECTION 5

Clutch and Controls

All information pertaining to model PD-4903 in CLUTCH AND CONTROLS as described in Maintenance Manual X-6814, pages 111 - 118, is applicable to models covered by this supplement.

SECTION 6

Cooling System

All information contained in Maintenance Manual X-6814 applies to coaches covered by this supplement except as specifically stated in this section.

SURGE TANK COOLANT LEVEL SIGHT GLASS

A sight glass (fig. 1) is incorporated in the surge tank for the purpose of checking coolant level. Sight glass is retained to tank cavity by means of screw-type threads which are molded on sight glass. Unit is sealed to tank through use of an O-ring type seal, and is easily removed by twisting glass in a counterclockwise direction.

CAUTION: DO NOT OVERTIGHTEN.

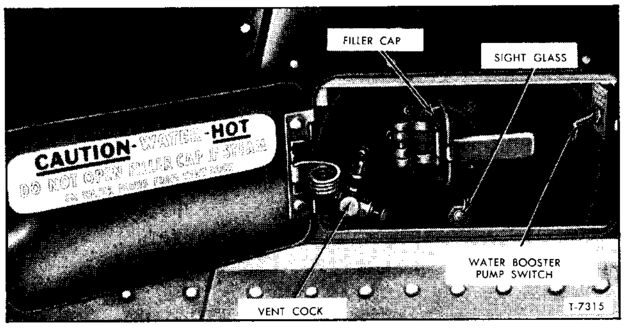


Figure 1—Cooling System Filler Cap, Vent Cock, Sight Glass, and Water Booster Pump Switch

LOSS-OF-COOLANT INDICATOR

The loss of coolant indicator is a transistorized device that warns the operator when a loss of coolant occurs in the engine cooling system during operation. The primary components of this device consist of a sensing probe which is mounted in the radiator surge tank and a transistorized indicator relay box located in the driver's control panel (figs. 2 and 3).

The sensing probe completes an electrical circuit to the indicator control unit by conducting current through the coolant in the surge tank. In the event that coolant is lost during engine operation (approximately eight to nine quarts), the circuit is broken and the transistorized control unit is activated. The tell-tale lamp on the instrument panel will then light and the alarm buzzer will sound. If the coach is equipped with an automatic engine shutdown, the engine will stop.

MAINTENANCE OF LOSS-OF-COOLANT INDICATOR

The control unit is a solid-state device and requires no maintenance. The stainless steel probe at surge tank will resist normal cooling system contamination and requires no adjustment or maintenance.

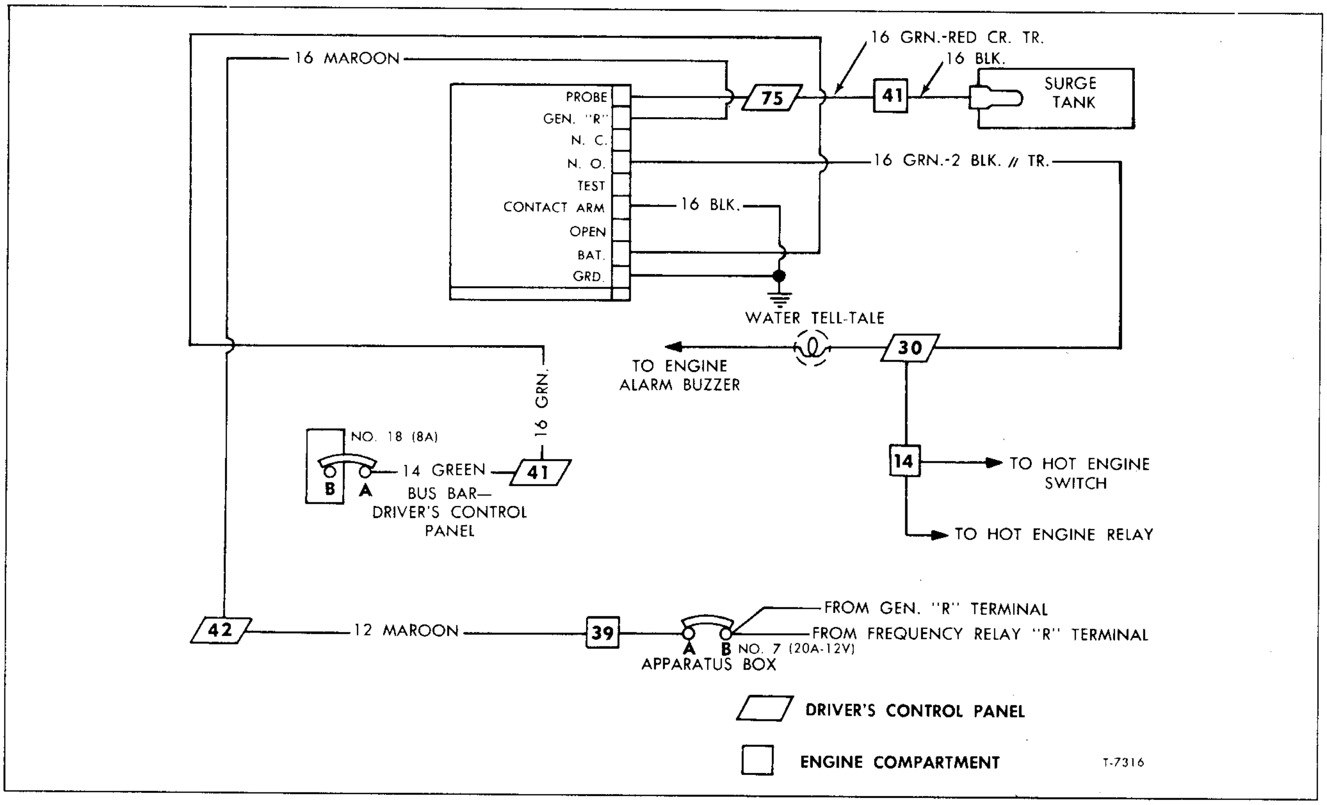


Figure 2—PD-4108 Coolant Loss Indicator Wiring Diagram

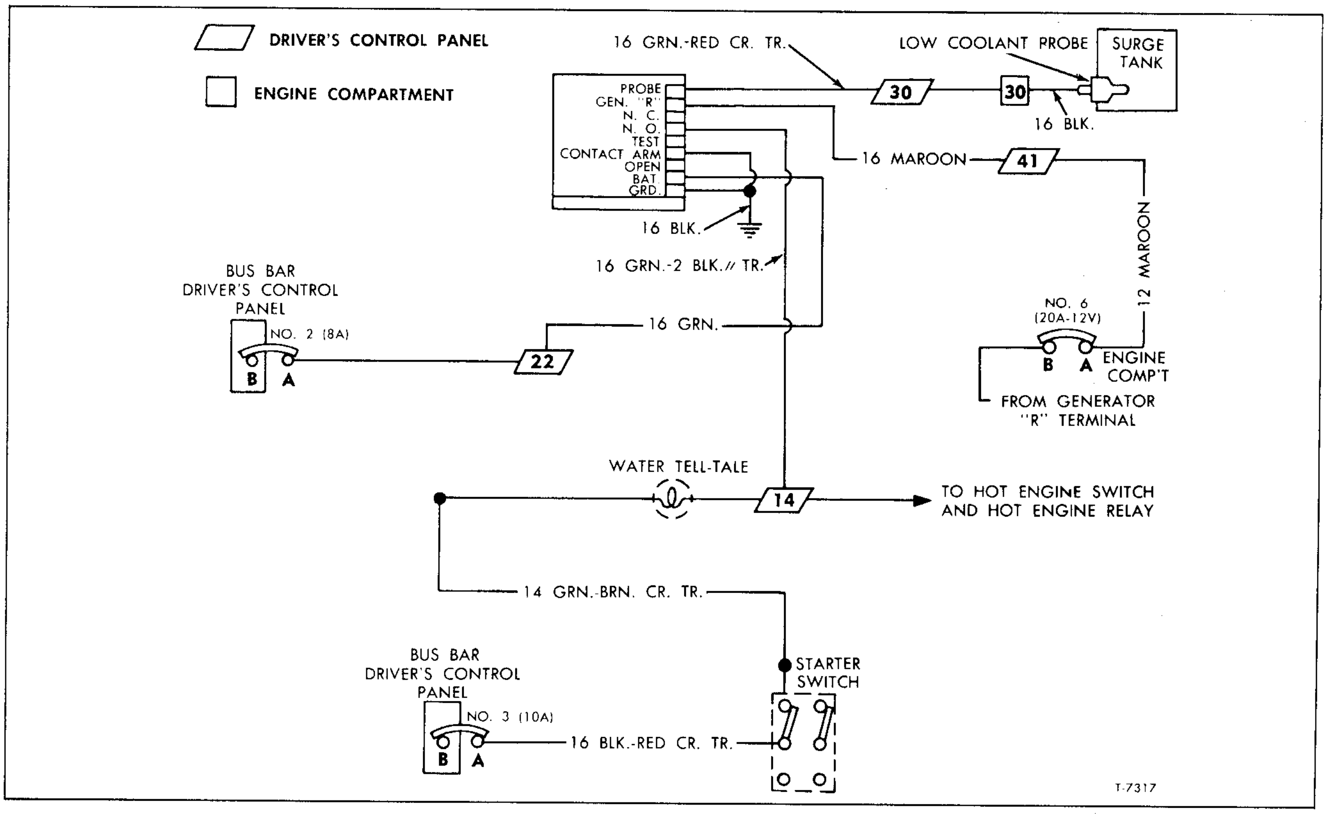


Figure 3—PD-4905 Coolant Loss Indicator Wiring Diagram

NOTE: On all coaches equipped with the Perry water filter, only the latest filter element Part No. 667800 should be used. This will prevent zinc chromate formation on the probe. Do not use radiator additives such as radiator stop leak compounds containing aluminum powder or other water treatments which tend to contaminate the probe.

TEST PROCEDURE

1. To check the indicator circuit, start the engine and observe the hot engine light. With the engine running, disconnect the wire from the probe at the surge tank which simulates water loss. The tell-tale will light, indicating control unit functions properly.
2. To check the probe circuit, reconnect probe wire and run engine while draining coolant from engine. Alarm will operate, indicating probe circuit functions properly.

CAUTION

USE ONLY STANDARD TYPE ETHYLENE-GLYCOL ANTI-FREEZE MEETING GENERAL MOTORS SPECIFICATIONS 1899-M.

A new type anti-freeze which contains a plastic bead anti-leak additive is now available. DO NOT USE THIS TYPE ANTI-FREEZE. There is a possibility of the anti-leak additive closing orifices designed into the diesel engine for de-aerating the cooling system which could result in overheating. This type anti-freeze could have adverse effects on radiator filler cap valving, water filter, and heating system, reducing their efficiency.

TROUBLESHOOTING CHART

FAULT	CHECK
Low Coolant (Surge Tank Empty) No Alarm or Light	1. No. 6 (4905) circuit breaker open. No. 7 (4108) circuit breaker open. 2. No generator R terminal voltage at control unit. 3. Probe circuit grounded to chassis. 4. Defective probe. 5. Defective control unit.
Defective, or Contaminated Probe	1. Disconnect wire from probe with engine operating - tell-tale and alarm should operate. NOTE: When grounding probe wire to chassis, tell-tale and alarm should shut off. This indicates that the control unit is operative. 2. Reconnect probe wire and drain surge tank. If alarm and tell-tale do not operate with engine operating, this indicates a defective probe.
Tell-Tale and Alarm Operate Continuously.	1. Probe wire disconnected or broken. 2. Control unit defective.
Intermittent Tell-Tale and Alarm	1. Coolant level low. 2. Loose probe connection. 3. Defective probe.
Tell-Tale and Alarm When Engine is Started Then Both Turn Off After Engine is Run For a Few Minutes.	1. Low coolant at cold level. Coolant expansion covers probe. 2. Defective probe. 3. Defective control unit.

COOLING SYSTEM SPECIFICATIONS

COOLING SYSTEM CAPACITIES

Quarts of Coolant Required (Approx.)*	92

*Includes Heating System.

ANTI-FREEZE CHART
(Based On 92 Qt. System)

Lowest Expected Temp. (°F.)	Qts. of Ethylene Glycol Required
+10	23
0	30½
−10	35
−20	39½
−30	43½

THERMOSTAT—WATER CIRCULATION

Number Used	2
Start to Open	180°
Fully Open	195°

OVERHEAT SWITCH (ALARMSTAT)

Make	AC
Vendor No.	6402829
Points Set to Close at	212°F ± 5°

SURGE TANK PRESSURE VALVE

Valve Opens at (Pressure in Lbs. per Sq. In.)	3½ to 4½

FAN

Number of Fan Blades	6
Diameter	30″
Direction of Rotation	Counterclockwise

TEMPERATURE GAUGE

Make	AC
Number	1513355
Operating Range	100°-260°
Voltage	24 Volts

SECTION 7

Electrical System

WARNING: THIS COACH IS EQUIPPED WITH A NEGATIVE GROUND ELECTRICAL SYSTEM.

Electrical system information pertaining to PD-4108 and PD-4905 coach models remains the same as covered under ELECTRICAL SYSTEM (SEC. 7) pages 125 through 202 in Maintenance Manual X-6814 except as follows:

This group, covering maintenance and repair information on Electrical Systems, is divided into sections shown in the Index below:

Section	Page No.
Wiring and Miscellaneous Electrical	30
Batteries	77
Starting System	79
Generator	88
Regulator Specifications	98
Lighting System	99

NOTE: Specifications are listed at end of each sub-section in this ELECTRICAL SYSTEM section.

INDEX OF ELECTRICAL UNITS

Certain electrical units, when closely associated with other systems or units, are covered in other sections of this supplement or in other sections of Maintenance Manual X-6814.

The following index lists all major electrical units together with the manual and section in which they are covered and page number on which section begins:

Unit	Manual	Sec.
Battery	X-7014	7
Buzzer, Engine Alarm	X-7014	7
Buzzer, Emergency*	X-7014	7
Buzzer, Low Air	X-7014	7
Flasher, Directional and Hazard Warning	X-7014	7
Flasher, Step Lamp	X-7014	7
Gauge, Engine Temperature . . .	X-6814	6
Gauge, Oil Pressure	X-6814	8
Gauge, Voltmeter	X-7014	7
Generator, Engine	X-7014	7
Generator, Air Conditioning . . .	X-7014	26
Horn	X-7014	7
Indicator, Low Coolant	X-7014	6
Lights	X-7014	7
Magnetic Switches	X-7014	7
Motor, Defroster Blower	X-7014	26
Motor, Heating, & Cooling Blower	X-7014	26
Motor, Water Booster Pump . . .	X-7014	26
Regulator, Voltage	X-7014	7
Relays	X-7014	7
Resistors	X-7014	7
Signal, Passenger Chime	X-7014	3
Signal, Directional	X-7014	7
Solenoid, A/C Clutch (N.C.)	X-7014	26
Solenoid, Emergency Stop	X-6814	8
Solenoid, Engine Stop (N.O.) . . .	X-6814	8
Solenoid, Fast Idle	X-6814	8
Solenoid, Intermediate Axle (N.C.)	X-6814	14
Solenoid, Reverse	X-6814	17
Solenoid, Starter	X-7014	7
Speedometer	X-7014	7
Starter	X-7014	7
Switch, Air Brake	X-6814	4
Switches, Air Conditioning	X-7014	26
Switch, Battery Disconnect	X-7014	7
Switch, Back-up Lamp	X-7014	7
Switch, Chime	X-7014	3
Switch, Defroster	X-7014	26
Switch, Emergency Stop	X-7014	7
Switch, Emergency*	X-7014	3
Switch, Engine Run	X-7014	7
Switch, Engine Control	X-7014	7
Switch, Fast Idle	X-7014	7
Switch, Fuel Pressure	X-7014	8
Switch, Heating & Air Conditioning	X-7014	26

*Denotes Special Equipment.

(Cont'd.)

Unit	Manual	Sec.
Switch, Hot Engine	X-7014	7
Switch, Lavatory Door Lock*	X-7014	3
Switch, Lavatory Emergency Buzzer*	X-7014	3
Switches, Lighting	X-7014	7
Switch, Low Air Pressure	X-7014	7
Switch, Low Oil Pressure	X-7014	7
Switch, Overrule*	X-7014	7
Switch, Passenger Signal Chime	X-7014	3
Switch, Rear Start	X-7014	7
Switch, Reverse	X-7014	17
Switch, Starter	X-7014	7
Switch, Transmission Oil Pressure	X-7014	17
Switch, Water Pump	X-7014	26
Switch, Wheels Down*	X-6814	14
Tell-tale Lights	X-7014	7
Thermostat, Engine Overheat	X-7014	8

*Denotes Special Equipment.

Wiring and Miscellaneous Electrical

INFORMATION CONTAINED IN THIS SECTION IS COMPLETE AND NOT SUPPLEMENTARY.

ELECTRICAL CIRCUIT DIAGRAMS

The electrical system is divided into several separate systems, each system being classified according to its junction or purpose. A separate wiring diagram is provided for each major system. In some cases, a circuit on one diagram ties in with circuits shown on other diagrams and cross references are made to other diagrams. Wiring diagrams in "Wiring Diagrams" booklet X-7014A, include standard wiring and the most commonly used special equipment wiring.

NOTE: Due to the many combinations and types of special equipment offered, it is impractical to include all special equipment wiring diagrams in this manual. Wiring diagrams covering particular special equipment can be obtained upon request from the factory. Following is a list of diagrams included in "Wiring Diagrams" booklet X-7014A.

COACH MODEL		
PD-4108	PD-4905	Description
MD-6918	MD-7173	Alarm and Signal Wiring Diagram
MD-6954	MD-7150	Coach Lighting Wiring Diagram
	MD-5375	Coach Lighting Wiring Diagram*
MD-6916	MD-7149	Directional Lamp Wiring Diagram
MD-6935	MD-7176	Engine Control and Generator Wiring Diagram
	MD-7374	Engine Control and Generator Wiring Diagram*
	MD-196	Entrance Door Curb Lamp Wiring Diagram
	MD-95742	Fire Alarm Wiring Diagram*
MD-6948	MD-2357	Flashing Step Lamp Wiring Diagram
	MD-4604	Fuel Gauge Wiring Diagram*
	MD-4625	Generator No-Charge Tell-Tale Wiring Diagram*
MD-6932	MD-7347	Heating and Air Conditioning Wiring Diagram
	MD-6919	In-Station Lighting Wiring Diagram*
MD-6936	MD-7180	Lavatory Wiring Diagram*
MD-7219	MD-7184	Master Wiring Diagram
	MD-7344	Public Address System Wiring Diagram*
MD-7126	MD-7148	Reading and General Lighting Wiring Diagram
		Retractable Inter-Axle Wiring Diagram
	MD-4611	Seat Lamp Wiring Diagram
MD-6913	MD-6756	Speedometer Wiring Diagram
	MD-4775	Tachograph Wiring Diagram*
MD-6941	MD-2063	Transmission Wiring Diagram

*Special Equipment Wiring Diagrams.

WIRE SIZES AND COLORS

Each wire in the electrical system is of a specific size as designated on the Wiring Diagrams. When replacing wires, the correct size as indicated must be used. Never replace a wire with one of a smaller size.

The insulation on each wire is distinctly colored and patterned to assist in tracing and testing circuits, and to assist in making connections.

Abbreviations and symbols are used in wire insulation color and pattern designations on Wiring Diagrams and in the tabulations which follow. Abbreviations and symbols are as follows:

*Blk. . . .	Black
Brn. . . .	Brown
Ch. . . .	Check
Cr. . . .	Cross
Grn. . . .	Green
Nat. . . .	Natural
Or. . . .	Orange
Tr. . . .	Tracer
Yell. . . .	Yellow
// . . .	Parallel

*All wires leading from electrical compartment junction box into engine compartment are covered with black heat-resistant insulation. To assist in making proper connections, a tag near end of each wire bears the number or abbreviation of the terminal to which it connects.

TESTING CIRCUITS

A careful study of the wiring diagrams should be made to determine the source and flow of current through each electrical circuit. When a circuit is thoroughly understood, a point-to-point check can be made with the aid of the applicable wiring diagram, to determine location of trouble. Any circuit can be tested for continuity or short circuits with a 2-candlepower test light or voltmeter.

All electrical connections must be kept clean and tight. Loose or corroded connections will cause discharged battery, difficult starting, dim lights, and improper functioning of other electrical circuits. Inspect all wiring connections at regular intervals. Make sure knurled nuts on all amphenol plugs are securely tightened. Refer to other sections previously listed under "Index of Electrical Units" for information on major electrical units and systems.

GAUGE, SWITCH, AND TELL-TALE PANEL

Gauge, switch, and tell-tale panel (fig. 1), mounted in front of driver has an air pressure gauge, oil pressure gauge, engine temperature gauge, voltmeter, hazard warning flasher switch, electric speedometer, and provisions for the optional dash-mounted fuel gauge and switch.

The tell-tale cluster, located across the top of the instrument panel, contains a green left turn indicator, and red tell-tale lights to indicate Low Air, Hot Engine, and Low Oil. The red tell-tale lights, located to right of the blue "Hi-Beam" tell-tale, are used to indicate Transmission Oil, Stop Lamp, and "A/C Stop." A green right turn indicator is mounted at right end of the cluster.

A vertical row of toggle type switches is located on each side of the console. The left switch panel controls the starter circuit, engine run circuit, engine stop overrule circuit (when specified), transmission reverse, and emergency stop.

The right switch panel controls the headlamp, taillamp, and marker lamp circuit, destination sign lights, reading lights, general lights, and the defroster circuit.

The hazard warning flasher switch is located at bottom of the left gauge panel between the oil and temperature gauges. A panel lamp located above each switch panel provides illumination for the various switches.

Additional air to the driver is supplied through an adjustable outlet on the left side of the instrument panel.

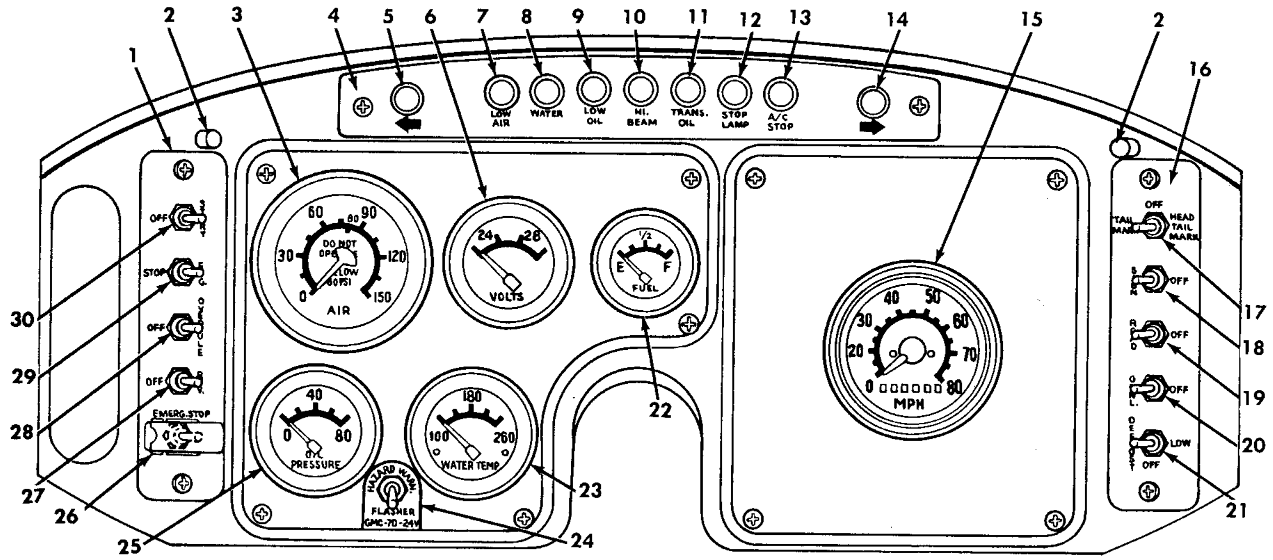
Snap-on type instrument lamp bulb sockets are part of the wiring harness assembly. Lamp bulbs are accessible after pulling socket from holder at back of instrument panel.

DRIVER'S CONTROL PANEL

Control panel, located at left of driver (fig. 2), contains switches for operation of driver's lamp, seat lamps, passenger chime, engine fast idle, heating and air conditioning controls, temperature range control, and driver's fan.

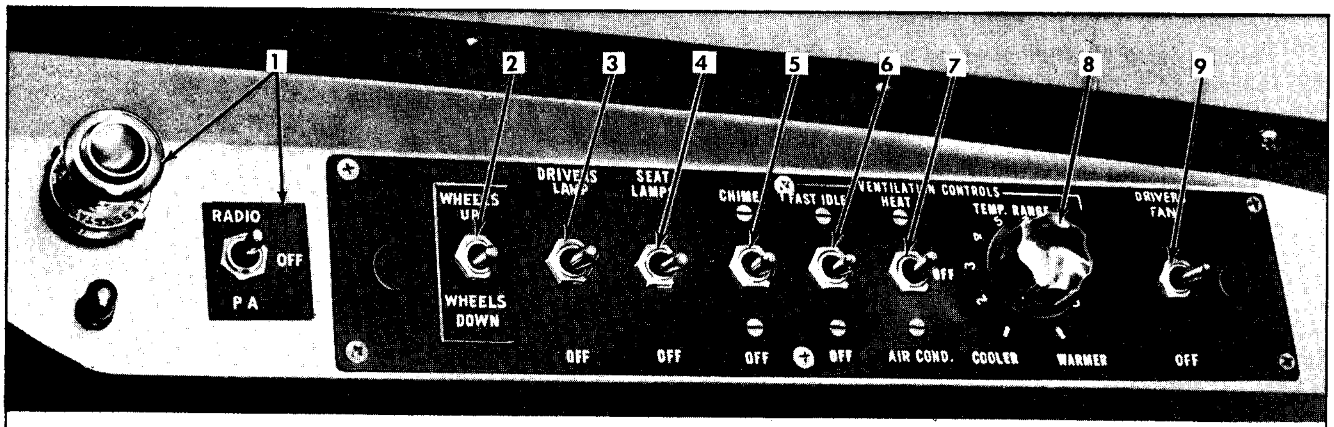
Additional plates are provided on the panel for special equipment application.

Junction panel (figs. 3 and 4), located below the control panel at left of driver, is accessible after removing the junction, circuit breaker, and



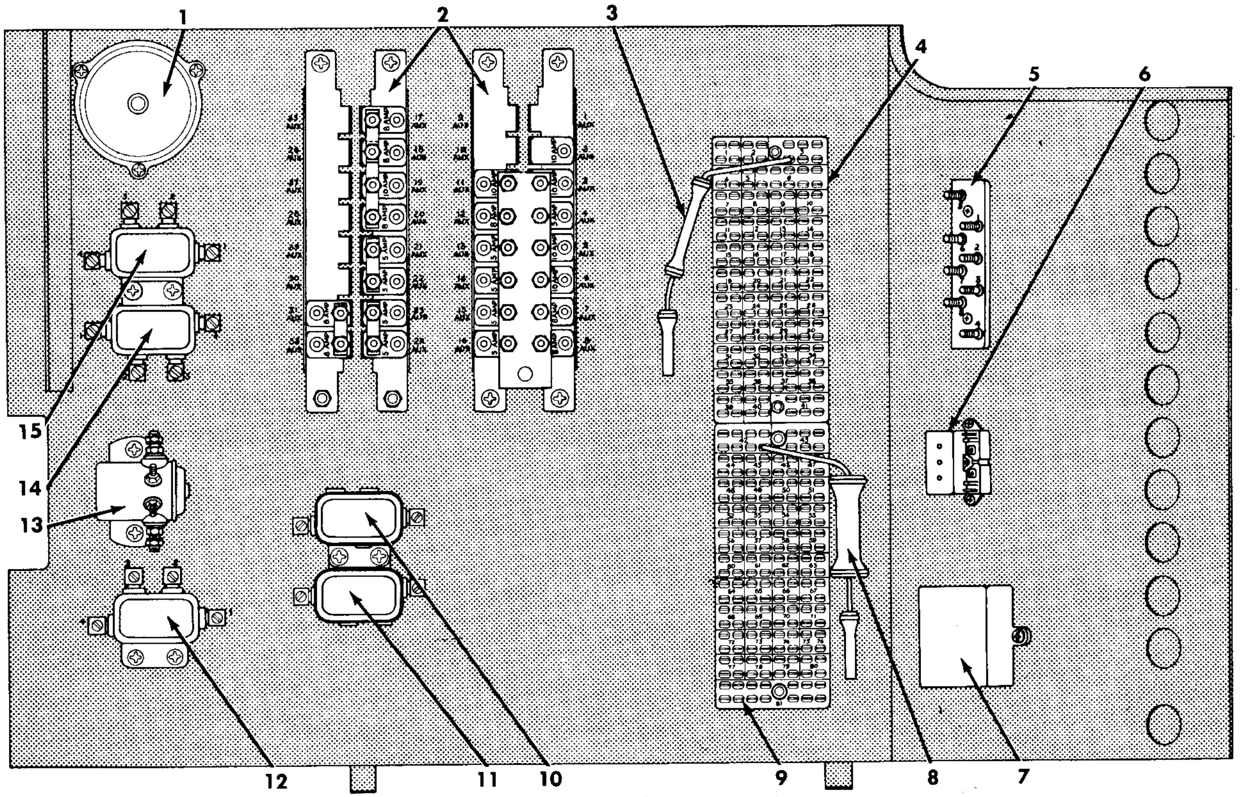
1 Driver's L.H. Side Switch Panel
2 Shielded Panel Lamp
3 Air Pressure Gauge
4 Tell-Tale Panel
5 Directional Signal Tell-Tale (Left-Hand) (Green)
6 Voltmeter Gauge
7 Low Air Tell-Tale (Red)
8 Water Tell-Tale (Red)
9 Low Engine Oil Tell-Tale (Red)
10 Hi-Beam Tell-Tale (Blue)
11 Transmission Oil Tell-Tale (Red)
12 Stop Lamp Tell-Tale (Red)
13 Air Conditioning Stop Tell-Tale (Red)
14 Directional Signal Tell-Tale (Right-Hand) (Green)
15 Speedometer Gauge
16 Driver's R.H. Side Switch Panel
17 Light Switch
18 Destination Sign Switch
19 Reading Lamp Switch
20 General Lamp Switch
21 Defroster Switch
22 Fuel Gauge (If Used)
23 Water Temperature Gauge
24 Hazard Warning Flasher Switch
25 Oil Pressure Gauge
26 Engine Emergency Stop Sw.
27 Transmission Reverse Sw.
28 Engine Overrule Switch (If Used)
29 Engine Run Switch
30 Engine Starter Switch T-7194

Figure 1—Gauge, Switch and Tell-Tale Panel (Typical)



1 Radio Controls (Special Equip.)
2 Inter-Axle Lift Control Switch (Special Equipment)
3 Driver's Lamp Switch
4 Seat Lamp Switch (Special Equipment)
5 Passenger Signal Chime Switch
6 Engine Fast Idle Switch
7 Heat and Air Conditioning Switch
8 Temperature Range Rheostat
9 Driver's Fan Switch T-7196

Figure 2—Driver's Control Panel (Typical)



1 Fire Alarm (Special Equipment)
2 Circuit Breaker Bracket, Bus Bar and Circuit Breakers
3 In-Line Diode Rectifier Assy.
4 Junction Block (Terminals 1 thru 41)
5 Junction Block (8 Terminal) (Special Equipment)
6 Stop Lamp Relay
7 Low Coolant Indicator
8 In-Line Diode Rectifier Assy.
9 Junction Block (Terminals 42 thru 81)
10 Low Air Alarm Buzzer
11 Low Engine Oil or Hot Engine Alarm Buzzer
12 Generator Control Relay
13 Engine Run Magnetic Switch
14 DD-3 Brake Stop Lamp Relay
15 Horn Relay

T-7197

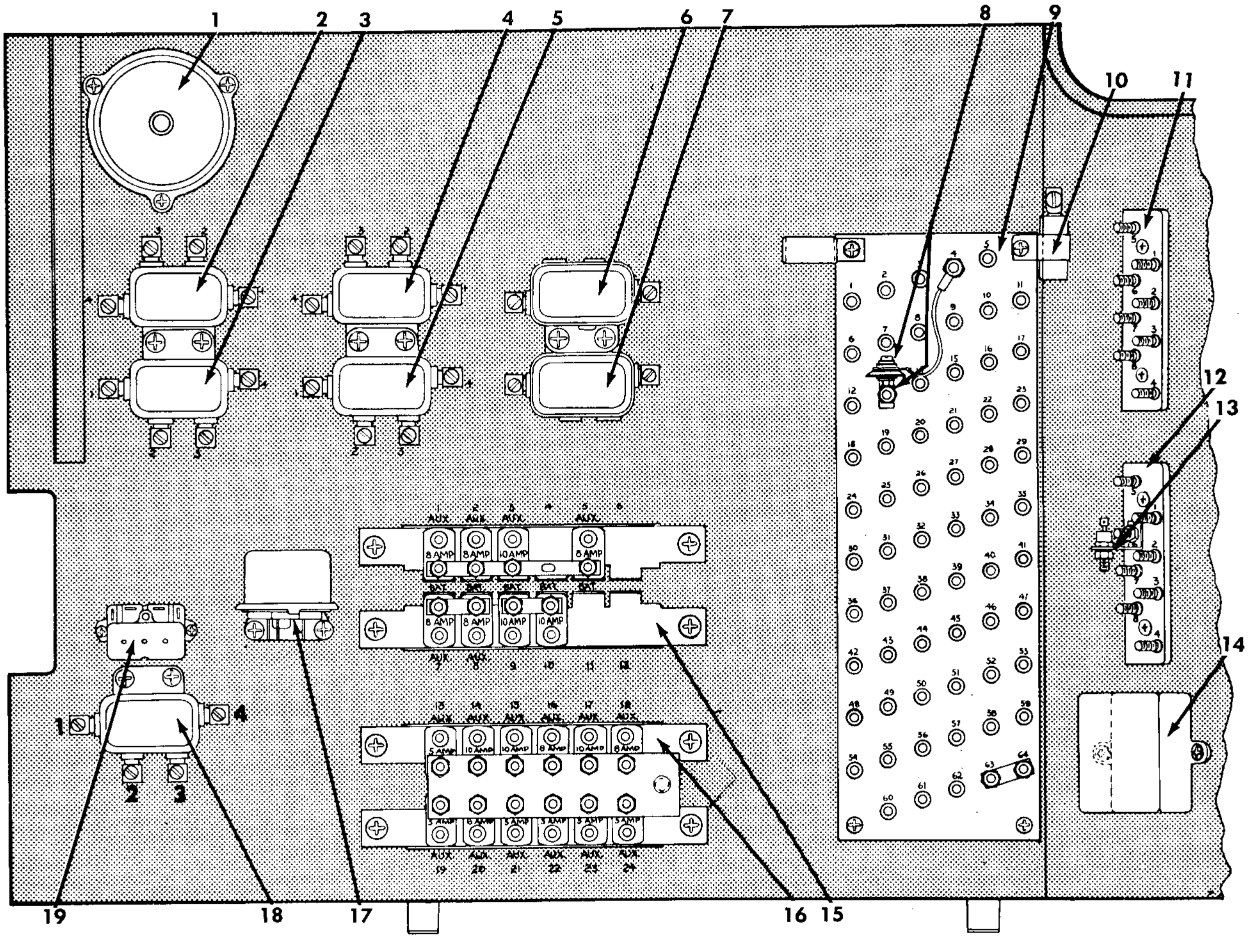
Figure 3—Driver's Control and Apparatus Panel (Model PD4108)

electrical apparatus panel cover.

The junction panel used on PD-4108 model coaches (fig. 3) contains two terminal blocks providing a total of 81 receptacles. The top terminal block contains terminal numbers 1 through 41 and the lower terminal block contains terminal numbers 42 through 81. Numbers on each terminal block correspond to numbers on wiring diagrams and in the tabulation which follows.

The junction panel used on PD-4905 model coaches (fig. 4), contains 64 terminal posts, numbered consecutively from 1 through 64. Numbers on junction panel correspond to numbers on Wiring Diagrams and in the tabulations which follow.

The tabulations which follow list each terminal number, the circuit it carries, and the size, color, and pattern of the wire which connects to each terminal. Some of the unused terminals marked "Open" or "Spare" in the tabulation, are available for use with additional special electrical equipment. Driver's control panel terminal block numbers appear in the symbol ▱ on Wiring Diagrams.



1 Fire Alarm Bell (Special Equipment)
2 Defroster Low Speed Relay
3 Horn Relay
4 Engine Run Relay
5 Heat and Air Conditioning Relay
6 Low Air Alarm Buzzer
7 Low Engine Oil or Hot Engine Alarm Buzzer
8 Rectifier and Bracket
9 Junction Block (64 Terminals)
10 Condenser (Special Equipment)
11 Junction Block (Special Equip.)
12 Auxiliary Junction Block
13 Rectifier and Bracket
14 Low Coolant Indicator
15 Bus Bar, Mounting Bracket and Circuit Breakers
16 Bus Bar, Mounting Bracket and Circuit Breakers
17 Defroster Hi-Speed Relay
18 DD-3 Brake Stop Lamp Relay
19 Stop Lamp Relay

T-7204

Figure 4—Driver's Control and Apparatus Panel (Model PD4905)

DRIVER'S CONTROL PANEL JUNCTIONS
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
1	STOP LAMP		
	From Stop Lamp Switch and DD3 Brake Stop Lamp Relay Terminal No. 2	16	Red-Nat. Tr.
	To Starter Switch (Normal)	16	Red-Nat. Tr.
2	TRANSMISSION REVERSE SWITCH		
	From Reverse Switch	16	Blk.-2 Red // Tr.
	To Engine Compartment Apparatus Box Junction 2	16	Blk.-2 Red // Tr.

DRIVER'S CONTROL PANEL JUNCTIONS
(MODEL PD-4108) (CONT'D.)

Terminal No.	Circuit	Wire Size	Color Code
3	ENGINE ALARM		
	From Engine Alarm Buzzer	16	Grn.-Blk. Tr.
	To Engine Compartment Apparatus Box Junction 4	16	Grn.-Blk. Tr.
	To Transmission Rectifier		White
4	OIL GAUGE		
	From Oil Pressure Gauge	16	Grn.-Nat. Cr. Tr.
	To Engine Compartment Junction 32	16	Grn.-Nat. Cr. Tr.
5	EMERGENCY STOP SWITCH		
	From Emergency Stop Switch	16	Grn.-Red Ch.
	To Engine Compartment Junction 5	16	Grn.-Red Ch.
6	MARKER LAMP		
	From Light Switch (MKR.-TAIL)	16	Brn.-Blk. Tr.
	To Front Marker Lamps	16	Brn.-Blk. Tr.
	To Front Seat Night Lamp (L.H.)	16	Brn.-Blk. Tr.
	To Intermediate Relay Panel Junction 5	16	Brn.-Blk. Tr.
	To Engine Compartment Junction 6	16	Brn.-Blk. Tr.
7	SPEEDOMETER		
	From Speedometer Head Cavity "S"	16	Blk.-Nat. Tr.
	To Engine Compartment Junction 7	16	Blk.-Nat. Tr.
8	LOW AIR BUZZER AND TELL-TALE		
	From Low Air Buzzer and Tell-Tale	16	Or.-2 Grn. // Tr.
	To Low Air Switch	16	Or.-2 Grn. // Tr.
9	SPARE		
	To Engine Compartment Junction 9	16	Grn.-2 Red // Tr.
	FIRE DETECTOR*		
	From Fire Alarm Bell to Engine Compartment Junction 9	16	Grn.-2 Red // Tr.
10	SPARE		
	To Engine Compartment Junction 10	16	Brn.
11	STOP LAMP RELAY		
	From Stop Lamp Relay Terminal 2	16	Red-2 Nat. // Tr.
	To Engine Compartment Junction 11	16	Red-2 Nat. // Tr.
12	STOP LAMP TELL-TALE		
	From Stop Lamp Relay Terminal No. 2	16	Red-Blk. Tr.
	To Stop Lamp Tell-tale	16	Red-Blk. Tr.
13	DIMMER SWITCH - HI-BEAM TELL-TALE		
	From Dimmer Switch "HI"	16	Dk. Grn.
	To Hi-Beam Tell-Tale	16	Brn.-Nat. Cr. Tr.
	To Driver's Control Panel No. 23 C.B.	16	Brn.-Red Tr.
14	DIMMER SWITCH "LO" AND RECTIFIER		
	From Dimmer Switch "LO"	16	Brn.
	From 6 Amp Line Fuse From Rectifier Connector		Blk.
	To Driver's Control Panel No. 21 C.B.	16	Brn. Grn. Tr.
15	WATCH STEP AND NIGHT LAMP		
	From Flashing Step Lamp Relay Terminal "1"	16	Nat.
	To Watch Step Sign	16	Nat.
	To Spliced Connector to Night Lamp and Watch Step Aisle Lamps	16	Blk.-Red Tr.
16	ENGINE RUN MAGNETIC SWITCH		
	From Engine Run Switch	16	Grn.-2 Blk. // Tr.
	To Engine Run Magnetic Switch	16	Grn.-2 Blk. // Tr.
17	SPEEDOMETER		
	From Speedometer Head "O"	16	Blk.-2 Nat. // Tr.
	To Engine Compartment Junction 17	16	Blk.-2 Nat. // Tr.
18	HEADLAMPS		
	From Light Switch	16	Yell.
	To Dimmer Switch	16	Yell.
19	STARTER SWITCH		
	From Starter Switch	16	Grn.-Blk. Tr.
	To Engine Compartment Junction 19	16	Grn.-Blk. Tr.

* Special Equipment.

WIRING AND MISC. ELECT.

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
20	TAIL AND LICENSE LAMP		
	From Spliced Connector From Light Switch ("HEAD, MKR., TAIL)	16	Or.-2 Blk. // Tr.
	To Engine Compartment Junction 20	16	Or.-2 Blk. // Tr.
21	R.H. DIRECTIONAL LAMP		
	From Directional Switch Connector Spliced Connection	16	Red-2 Grn. // Tr.
	To R.H. Side Directional Lamp	16	Red-2 Grn. // Tr.
	To Engine Compartment Junction 21	16	Red-2 Grn. // Tr.
22	L.H. DIRECTIONAL LAMP		
	From Directional Switch Connector Spliced Connection	16	Red-Grn. Cr. Tr.
	To L.H. Side Directional Lamp	16	Red-Grn. Cr. Tr.
	To Engine Compartment Junction 22	16	Red-Grn. Cr. Tr.
23	SPARE		
	To Engine Compartment Junction 23	16	Grn.-Red Tr.
	AUTOMATIC ENGINE STOP*		
	From Overrule Switch	16	Grn.-Red Tr.
	To Engine Compartment Junction 23	16	Grn.-Red Tr.
24	LOW OIL TELL-TALE		
	From Low Oil Tell-Tale	16	Grn.-2 Nat. // Tr.
	To Engine Compartment Junction 24	16	Grn.-2 Nat. // Tr.
25	FAST IDLE SWITCH ENGINE CONTROL		
	From Fast Idle Switch	16	Grn.-Nat. Tr.
	To Engine Compartment Junction 25	16	Grn.-Nat. Tr.
26	SPARE		
	Instrument Cluster Harness to Engine Comp't. Junction 26	16	Blk.-2 Grn. // Tr.
27	SPARE		
	Instrument Cluster Harness to Engine Comp't. Junction 27	16	Blk.-Grn. Tr.
28	FAST IDLE SWITCH - ENGINE CONTROL		
	From Air Brake Switch	16	Grn.-Nat. Tr.
	To Fast Idle Switch	16	Grn.-Nat. Tr.
	To DD3 Brake Stop Lamp Relay Terminal "3"	16	Grn.-Nat. Tr.
29	TRANSMISSION LOW OIL TELL-TALE		
	From Rectifier From Driver Control Panel Junction 3		White
	To Transmission Low Oil Tell-tale and Engine Comp't. Junction 13	16	Blk.-Red Tr.
30	HOT ENGINE TELL-TALE & COOLANT INDICATOR		
	From Water Tell-tale	16	Grn.-2 Blk. // Tr.
	To Engine Compartment Junction 14	16	Grn.-2 Blk. // Tr.
	To Low Coolant Indicator "N.O."	16	Grn.-2 Blk. // Tr.
31	OPEN		
32	OPEN		
33	DESTINATION SIGN		
	From Destination Sign Switch	16	Brn.-Blk. & Nat. Cr. Tr.
	To Line Connectors to Front Destination Sign	16	Brn.-Blk. & Nat. Cr. Tr.
	To Side Destination Sign*	16	Brn.-Blk. & Nat. Cr. Tr.
34	READING LAMP		
	From Interior Light Switch "READING"	16	Nat.-2 Blk. // Tr.
	To Intermediate Relay Panel Junction 1	16	Nat.-2 Blk. // Tr.
35	GENERAL LAMPS		
	From Interior Light Switch "GENERAL"	16	Nat.-Blk. Tr.
	To Intermediate Relay Panel Junction 4	16	Nat.-Blk. Tr.
36	WATER PUMP RELAY		
	From Heat - A/C Switch "HEAT"	16	Yell.-Red Tr.
	To Water Pump Relay Terminal No. 3	16	Yell.-Red Tr.
37	SPARE		
	From Instrument Cluster Harness (Taped)	16	Nat.-Blk. // Tr.
38	SPARE		
	To Bolted Connector At Lavatory	16	Blue-Nat. Cr. Tr.
	LAVATORY*		
	From Driver's Control Panel No. 17 C.B.	16	Blue-Nat. Cr. Tr.
	To Bolted Connector to Lavatory Door Switch "N.C."	16	Blue-Nat. Cr. Tr.
39	SPARE		
	To Bolted Connector at Lavatory	16	Blue-Nat. Tr.
	LAVATORY*		
	From Bolted Connector From Emergency Switch	16	Blue-Nat. Tr.
	To Emergency Buzzer	16	Blue-Nat. Tr.

* Special Equipment.

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
40	STOP LAMP RELAY		
	From Starter Switch "NORMAL"	16	Red-Grn. Tr.
	To Stop Lamp Relay Terminal No. 4	16	Red-Grn. Tr.
41	ENGINE CONTROL		
	From Driver's Control Panel No. 18 C.B.	14	Green
	To Air Brake Switch	16	Green
	To Engine Compartment Junction No. 3	16	Green
	To Spliced Connector to Overrule Switch*; To Taped Spare - To REVERSE Switch, and To Trans. Low Oil Tell-tale	16	Grn.
42	GENERATOR RELAY - LOW COOLANT AND SPEEDOMETER		
	From Engine Compartment Junction 39	12	Maroon
	To Generator Relay Terminal No. 3	16	Maroon
	To 4A Line Fuse to Speedometer Head "+"	16	Maroon
	To Low Coolant Indicator "GEN. R"	16	Maroon
	To Rectifier to 6A Fuse to Driver's Control Panel Jct. 14		White
43	STARTER SWITCH		
	From Spliced Connector From Starter Switch "NORMAL"	16	Grn.-Brn. Cr. Tr.
	To Engine Alarm Buzzer "Coil"	14	Grn.-Brn. Cr. Tr.
	To Engine Compartment Junction 29	14	Grn.-Brn. Cr. Tr.
44	HEATING		
	From Heat - A/C Switch "HEAT"	16	Yell.
	To Temperature Control	16	Yell.
	To L.H. & R.H. Blower Magnetic Switch "Coil"	16	Yell.
45	AIR CONDITIONING		
	From Heat & A/C Switch "A/C"	16	Yell.-Grn. Tr.
	To Spliced Connector to Condenser Fan Magnetic Switch "Coil" - "HI-LO" Pressure Sw. "COM" and "HI-SPEED" Pressure Switch	16	Yell.-Grn. Tr.
46	A/C STOP TELL-TALE		
	From Engine Compartment Junction 12	16	Yell.-Blk. Cr. Tr.
	To A/C Tell-Tale	16	Yell.-Blk. Cr. Tr.
47	DEFROSTER FAN HIGH SPEED		
	From Defroster Switch "HI"	16	Yell.-2 Blue // Tr.
	To Bolted Connector to Defroster Fans	16	Yell.-2 Blue // Tr.
48	DEFROSTER FAN LOW SPEED		
	From Defroster Switch "LO"	16	Yell.-Blk. Tr.
	To Bolted Connector to Defroster Fan	16	Yell.-Blk. Tr.
49	HORN		
	From Horn Relay Terminal No. 2	14	Brn.-Blk. & Red Cr. Tr.
	To Spliced Connector to Horns	14	Brn.-Blk. & Red Cr. Tr.
50	HORN BUTTON		
	From Directional Switch Connector	16	Brn.-Red Ch.
	To Horn Relay Terminal No. 3	16	Brn.-Red Ch.
51	SPARE		
	To Intermediate Relay Panel Junction 10	16	Nat.-Blk. Cr. Tr.
	SEAT LAMPS*		
	From Seat Lamp Switch	16	Nat.-Blk. Cr. Tr.
	To Intermediate Relay Panel Jct. 10	16	Nat.-Blk. Cr. Tr.
52	OPEN		
53	DRIVER'S LAMP		
	From Driver's Fan Switch	16	Yell.-Blue Tr.
	To Driver's Fan Connector	16	Yell.-Blue Tr.
54	SPARE		
	To Intermediate Relay Panel Junction 7	14	Natural
	REAR WHEEL SANDER*		
	-		
	-		
55	SPARE		
	To Ventilation Compartment Junction	16	Or.-Grn. Tr.
	FUEL GAUGE*		
	-		
	-		
56	SPARE		
	To Engine Compartment Apparatus Box - Taped Connector	16	Yell.-2 Blue // Tr.

* Special Equipment.

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
57	PASSENGER CHIME		
	From Passenger Chime To Chime Switch	16	Grn.-Red Ch.
58	PASSENGER CHIME		
	From Chime Switch To L.H. & R.H. Passenger Signal Sw.		
59	OPEN		
60	STOP LAMP SWITCH		
	From Driver's Control Panel No. 14 C.B.	16	Red
	To Stop Lamp Switch	16	Red
61	SPARE		
	To Intermediate Relay Panel Junction 9	16	Yell.-Grn. Tr.
62	STEP LAMP		
	From Spliced Connector From Step Lamp Switch	16	Or.
	To Step Lamp Line Connector	16	Or.
63	OPEN		
64	DRIVER'S LAMP		
	From Driver's Lamp Switch	16	Nat.-Red Tr.
	To Line Connector To Driver's Lamp	16	Nat.-Red Tr.
65	SPARE		
	Taped in Engine Compartment Apparatus Box	16	Blk.-2 Red // Tr.
66	OPEN		
67	OPEN		
68	OPEN		
69	TEMPERATURE CONTROL		
	From Temperature Control	16	Yell.-2 Blue // Tr.
	To Grad-U-Stat Resistor	16	Yell.-2 Blue // Tr.
70	SPARE		
	To Intermediate Relay Panel Junction 2	16	Nat.-Blk. & Red // Tr.
71	OPEN		
72	SPARE		
	To Intermediate Relay Panel Junction 14	16	Yell.-Blue Tr.
73	OPEN		
74	OPEN		
75	LOW COOLANT INDICATOR		
	From Low Coolant Indicator "PROBE"	16	Blk.-Red Cr. Tr.
	To Engine Compartment Junction 41	16	Blk.-Red Cr. Tr.
76	ENGINE TEMPERATURE GAUGE		
	From Engine Temperature Gauge (SEND)	16	Grn.-Blk. Cr. Tr.
	To Engine Compartment Junction 42	16	Grn.-Blk. Cr. Tr.
77	SPARE		
	Taped in Engine Compartment Apparatus Box	16	Blue-2 Nat. // Tr.
78	OPEN		
79	SPARE		
	To Defroster Switch	16	Yell.-Red Tr.
80	OPEN		
81	GROUND		Black

* Special Equipment.

DRIVER'S CONTROL PANEL JUNCTIONS
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1	STOP LAMP SWITCH RELAY		
	From Stop Lamp Switch & DD3 Brake Stop Lamp Relay Terminal No. 2	16	Red-Nat. Tr.
	To Starter Switch (NORMAL)	16	Red-Nat. Tr.
2	EMERGENCY STOP SWITCH		
	From Emergency Stop Switch To Engine Comp't. Junction 2.	16	Grn.-Red Tr.
3	TRANSMISSION REVERSE SWITCH		
	From Transmission Reverse Switch To Engine Compartment Junction No. 3	16	Blk.-2 Red // Tr.
4	ENGINE ALARM BUZZER		
	From Engine Alarm Buzzer	16	Grn.-Blk. Tr.
	To Engine Compartment Junction No. 4	16	Grn.-Blk. Tr.
	To Rectifier To Driver's Control Panel Junction 13		White
5	OIL GAUGE		
	From Oil Gauge "Send."	16	Grn.-Nat. Cr. Tr.
	To Engine Compartment Junction 5	16	Grn.-Nat. Cr. Tr.
6	MARKER LAMPS		
	From Light Switch	16	Brn.-Blk. Tr.
	To Engine Compartment Junction 6	16	Brn.-Blk. Tr.
	To Spliced Connector To Front Marker Lamps	16	Brn.-Blk. Tr.
	To Spliced Connector To Front Seat Night Lamps (L.H.) and Regulator Panel Junction 5L	16	Brn.-Blk. Tr.
7	SPEEDOMETER		
	From Speedometer Head "S" To Engine Comp't. Junction 7.	16	Blk.-Nat. Tr.
8	LOW AIR BUZZER AND TELL-TALE		
	From Low Air Buzzer and Tell-tale to Low Air Switch	16	Or.-2 Grn. // Tr.
9	SPARE		
	To Engine Compartment Junction 9	18	Grn.-2 Red // Tr.
	FIRE DETECTORS*		
	From Fire Alarm Bell To Engine Compartment Junction 9.	18	Grn.-2 Red // Tr.
10	HEADLAMPS		
	From Light Switch "HEAD-TAIL"	16	Yell.
	To Dimmer Switch	16	Yell.
11	STOP LAMPS		
	From Stop Lamp Relay Terminal No. 3	16	Red-2 Nat. // Tr.
	To Engine Compartment Junction 11	16	Red-2 Nat. // Tr.
12	STOP LAMP TELL-TALE		
	From Stop Lamp Relay Terminal No. 2	16	Red-Blk. Tr.
	To Stop Lamp Tell-Tale	16	Red-Blk. Tr.
13	TRANSMISSION LOW OIL TELL-TALE		
	From Rectifier From Driver's Control Panel Junction 4		White
	To Transmission Low Oil Tell-Tale	16	Blk.-Red Tr.
	To Engine Compartment Junction 13	16	Blk.-Red Tr.
14	HOT ENGINE TELL-TALE		
	From Hot Engine Relay Terminal "3"	16	Grn.-2 Blk. // Tr.
	To Low Coolant Indicator "N.O."	16	Grn.-2 Blk. // Tr.
	To Water Tell-tale and Engine Compartment Junction 4	16	Grn.-2 Blk. // Tr.
15	ENGINE TEMPERATURE GAUGE		
	From Engine Temperature Gauge "Send"	16	Grn.-Blk. Cr. Tr.
	To Engine Compartment Junction 15		
16	ENGINE RUN RELAY		
	From Engine Run Switch To Engine Run Relay Term. No. 3.	16	Grn.-2 Blk. // Tr.
17	SPEEDOMETER		
	From Speedometer Head Cavity "O" To Engine Compartment Junction 17	16	Blk.-2 Nat. // Tr.
18	WATCH STEP AND NIGHT LAMPS		
	From Flashing Step Lamp Relay Terminal No. 1	16	Nat.
	To Watch Step Sign	16	Nat.
	To Night Lamp on Second L.H. Seat	16	Blk. & Red Tr. (P & C)
	To Watch Step Aisle Lamps*	16	Nat.
19	STARTER SWITCH		
	From Starter Switch "START"	16	Grn.-Blk. Tr.
	To Engine Compartment Junction 19	16	Grn.-Blk. Tr.
20	TAIL LAMPS AND INSTRUMENT PANEL LAMPS		
	From Spliced Conn. From Light Sw. "HEAD-TAIL"	16	Or.-2 Blk. // Tr.
	To Engine Compartment Junction 20	16	Or.-2 Blk. // Tr.

*Special Equipment.

(Continued)

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
21	R.H. DIRECTIONAL LAMPS		
	From Spliced Connector From Directional Signal Sw. Conn.	16	Red-2 Grn. // Tr.
	To R.H. Side Directional Lamp and Engine Comp't. Jct. 21	16	Red-2 Grn. // Tr.
22	ENGINE CONTROL		
	From Driver's Control Panel No. 2 C.B.	14	Grn.
	To Air Brake Switch	16	Grn.
	To Engine Compartment Jct. 22	16	Grn.
	To Low Coolant Indicator "BATT."	16	Grn.
	To Spliced Connector To Trans. Low Oil Tell-Tale; Transmission Reverse Switch and Taped Spare	16	Grn.
	To Overrule Switch*	16	Grn.
23	SPARE		
	To Engine Compartment Junction 23	16	Grn.-Red Tr.
	ENGINE AUTOMATIC STOP*		
	From Overrule Switch	16	Grn.-Red Tr.
	To Engine Compartment Junction 23	16	Grn.-Red Tr.
24	LOW OIL TELL-TALE		
	From Low Oil Relay Terminal No. 3	16	Grn.-2 Nat. // Tr.
	To Low Oil Tell-Tale and Engine Compartment Junction 24		
25	FAST IDLE SWITCH ENGINE CONTROL		
	From Fast Idle Switch To Engine Compartment Junction 25	16	Grn.-Nat. Tr.
26	OPEN		
27	SPARE		
	To Engine Compartment Junction 27	16	Blk.-Grn. Tr.
28	FAST IDLE SWITCH - ENGINE CONTROL		
	From Fast Idle Switch and Air Brake Switch	16	Grn.-Nat. Tr.
	To DD3 Brake Stop Lamp Relay Terminal No. 3	16	Grn.-Nat. Tr.
29	STARTER SWITCH		
	From Spliced Connector From Starter Switch "NORMAL"	14	Grn.-Brn. Cr. Tr.
	To Engine Alarm Buzzer "Coil"	14	Grn.-Brn. Cr. Tr.
	To Engine Compartment Junction 29	14	Grn.-Brn. Cr. Tr.
30	LOW COOLANT		
	From Low Coolant Indicator "Probe"	16	Blk.-Red Cr. Tr.
	To Engine Compartment Junction 30	16	Blk.-Red Cr. Tr.
31	L.H. DIRECTIONAL LAMPS		
	From Spliced Connector From Directional and Hazard Warning Switch Connectors	16	Red-Grn. Cr. Tr.
	To L.H. Front Directional Lamp, L.H. Directional Tell-Tale, L.H. Side Directional Lamp and Engine Compartment Junction 31	16	Red-Grn. Cr. Tr.
32	HI-BEAM TELL-TALE		
	From Dimmer Switch "Hi"	16	Dk. Grn.
	To Hi-Beam Tell-Tale	16	Brn.-Nat. Cr. Tr.
	To Tool Compartment Bus Bar No. 1 C.B.	16	Brn.-Red Tr.
33	DESTINATION SIGN		
	From Destination Sign Switch	16	Brn.-Blk. & Nat. Cr. Tr.
	To Front Destination Sign Line Connector	16	Brn.-Blk. & Nat. Cr. Tr.
	To Side Destination Sign*	16	Brn.-Blk. & Nat. Cr. Tr.
34	READING LAMPS		
	From Interior Light Switch "READING"	16	Nat.-2 Blk. // Tr.
	To Regulator Panel Junction 1L	16	Nat.-2 Blk. // Tr.
35	GENERAL LAMPS		
	From Interior Light Switch "GENERAL"	16	Nat.-Blk. Tr.
	To Regulator Panel Junction 4L	16	Nat.-Blk. Tr.
36	WATER PUMP RELAY		
	From Heat-Air Cond. Switch "HEAT"	16	Yell.-Red Tr.
	To Water Pump Relay Terminal No. 3	16	Yell.-Red Tr.
37	SPARE		
	To Engine Compartment Junction 37	16	Blk.-2 Grn. // Tr.
	SPEEDOMETER*		
	From Instrument Cluster Harness To Engine Comp't. Jct. 37	16	Blk.-2 Grn. // Tr.
38	SPARE		
	To Regulator Panel Junction 3L	16	Blue-Nat. Cr. Tr.
	LAVATORY*		
	From Driver's Control Panel No. 1 C.B.	16	Blue-Nat. Cr. Tr.
	To Regulator Panel Junction 3L	16	Blue-Nat. Cr. Tr.

*Special Equipment.

(Continued)

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
39	SPARE		
	To Regulator Panel Junction 2L	16	Blue-Nat. Tr.
	LAVATORY*		
	From Regulator Panel Junction 2L	16	Blue-Blk. Tr.
	To Emergency Buzzer	16	Blue-Blk. Tr.
40	OPEN		
41	SPEEDOMETER, HEADLAMPS, LOW COOLANT		
	From Engine Compartment Apparatus Box No. 6 C.B. . . .	12	Maroon
	To Low Coolant Indicator "GEN-R"	16	Maroon
	To 6A Line Fuse to Rectifier To Driver's Control Panel Auxiliary Junction A6	16	Brn.-Grn. Tr.
	To 4A Line Fuse To Speedometer Head "+"	16	Maroon
42	GENERATOR RELAY		
	From Regulator Panel No. 6 C.B.	16	Gray
	To Heating and A/C Relay Terminal No. 3	16	Gray
43	TEMPERATURE CONTROL		
	From Temperature Control	16	Yell.-2 Blu. // Tr.
	To Grad-U-Stat Resistor	16	Yell.-2 Blue // Tr.
44	HEATING		
	From Spliced Connector From Heating & Air Cond. Switch .	16	Yell.
	To Blower Motor Magnetic Switch "Coil"	16	Yell.
45	AIR CONDITIONING		
	From Heat-Air Cond. Switch "A/C"	16	Yell.-Grn. Tr.
	To Defroster Hi-Speed Cut-Out Relay Terminal No. 5 . . .	16	Yell.-Grn. Tr.
	To Spliced Conn. To Regulator Panel Junction 3R and Dead End Taped Wire	16	Yell.-Grn. Tr.
46	AIR CONDITIONING TELL-TALE		
	From Regulator Panel Junction 6L To A/C Tell-Tale . . .	16	Yell.-Blk. Cr. Tr.
47	Defroster Fans and Low Speed Relay From Defroster Sw. "Hi"	16	Yell.-2 Blue // Tr.
	To Defroster Low Speed Relay Terminal No. 4	16	Yell.-2 Blue // Tr.
	To Bolted Connector To Defroster Fans	14	Yell.-2 Blk. // Tr.
48	DEFROSTER FANS AND HI-SPEED RELAY		
	From Defroster Hi-Speed Cut-Out Relay Terminal 1	16	Blk.-Yell. Ch.
	To Bolted Connector To Defroster Fans	14	Yell.-2 Blk. // Cr. Tr.
49	HORN		
	From Horn Relay Terminal No. 2	14	Brn.-Blk. & Red Cr. Tr.
	To Spliced Connector To Horns	16	Brn.-Blk. & Red Cr. Tr.
50	HORN BUTTON		
	From Horn Relay Terminal No. 3	16	Brn.-Red Ch.
	To Directional Switch Connector To Horn Button	16	Brn.-Red Ch.
51	SPARE		
	To Regulator Panel Junction 4R	16	Nat.-Blk. Cr. Tr.
	SEAT LAMP*		
	From Seat Lamp Switch To Regulator Panel Junction 4R . . .	16	Nat.-Blk. Cr. Tr.
52	DRIVER'S LAMP		
	From Driver's Control Panel No. 21 C.B.	16	Nat.-Blk. Cr. Tr.
	To Driver's Lamp Switch	16	Nat.-Blk. Cr. Tr.
	To Seat Lamp Switch*	16	Nat.-Blk. Cr. Tr.
53	DRIVER'S FAN		
	From Driver's Fan Switch To Connector To Driver's Fan . .	16	Yell.-Blue Tr.
54	SPARE		
	To Regulator Panel Junction 1R	14	Nat.
	Rear Wheel Sanders*		
55	SPARE		
	To Battery Compartment	16	Or.-Grn. Tr.
	FUEL GAUGE*		
	-		
	-		
56	DEFROSTER SWITCH		
	From Defroster Switch	16	Yell.-Blk. Tr.
	To Defroster Hi-Speed Cut-Out Relay Terminal 2	16	Yell.-Blk. Tr.
57	PASSENGER CHIME		
	From Passenger Chime To Chime Switch	16	Grn.-Red Ch.
58	PASSENGER CHIME SWITCH		
	From Chime Switch To Spliced Connector To Passenger Signal Switches	16	Grn.-Red Ch.

(Continued)

DRIVER'S CONTROL PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
59	SPARE		
	To Regulator Panel	16	Blk.-Red Cr. Tr.
60	STOP LAMP SWITCH		
	From Driver's Control Panel No. 22 C.B.	16	Red
	To Stop Lamp Switch & DD3 Brake Stop Lamp Relay Terminal No. 1	16	Red
61	OPEN		
62	STEP LAMP		
	From Connector From Step Lamp Switch	16	Or.
	To Connector To Flashing Step Lamp Relay Terminal No. 4	16	Or.
	To Line Connector To Step Lamp	16	Or.
63	OPEN		
64	GROUND		Blk.

DRIVER'S CONTROL PANEL AUXILIARY JUNCTIONS A

Terminal Letter	Circuit	Wire Size	Color Code
A1	DRIVER'S LAMP GROUND		
	From Driver's Lamp Switch	16	Nat.-Red Tr.
	To Line Connector To Driver's Lamp	16	Nat.
A2	SPARE - HEATING		
	From Defroster Switch	16	Yell.-Red Tr.
A3	OPEN		
A4	SPARE		
	To Engine Compartment Junction 10	16	Brown
A5	SPARE		
	Wheels Skinner Valve*		
	From Wheels Switch "UP"	16	Or.
	To Spliced Connector To Intermediate Axle Solenoid "N.C."	16	Or.
A6	HEADLAMPS		
	From Dimmer Switch "LOW"	16	Brn.
	From Rectifier & Line Fuse From Driver's Control Panel Junction 41	16	Brn.-Grn. Tr.
	To Tool Compartment Bus Bar No. 4C.B.	16	Brn.-Grn. Tr.
A7	STOP LAMP RELAY		
	From Starter Switch	16	Red-Grn. Tr.
	To Stop Lamp Relay Terminal No. 4	16	Red-Grn. Tr.
A8	OPEN		

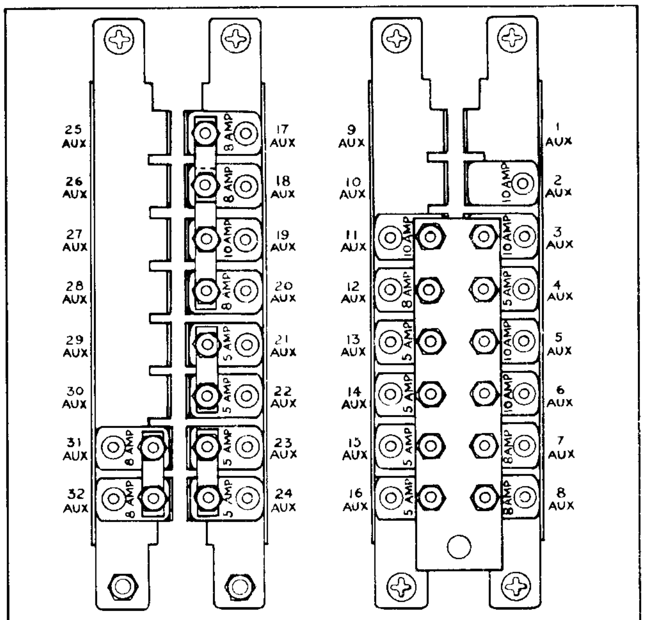
DRIVER'S CONTROL PANEL CIRCUIT BREAKERS

Circuit breaker panel, located on apparatus panel at left of driver's seat, is accessible after removing the panel cover.

Circuit breakers are automatic reset type, protecting various circuits as indicated in the tabulation which follows. Any condition which causes an overload on a circuit, such as a short, will cause circuit breaker bimetallic element to open circuit; when element cools, circuit breaker will again close circuit. This off and on cycle will repeat until switch controlling defective circuit is turned off, or until cause of overload has been located and corrected. In the event a circuit breaker becomes defective (burns out or sticks closed), the defective circuit breaker must be replaced.

Circuit breaker numbers shown on Wiring Diagrams and in the tabulation which follows do not appear on the circuit breakers or on the panel; to identify circuit breakers, it is necessary to refer to figure 5 for location and amperage rating of each circuit breaker used on the PD-4108 Model coach or figure 6 for location and amperage rating of each circuit breaker used on the PD-4905 model coach. Circuit breakers must be installed so the feed or battery wire (or bus bar) connects to the "BAT" or short terminal, and the wire carrying the circuit to the electrical units connects to the "AUX." or long terminal.

The following tabulation lists each circuit breaker number (as identified on figure 5 or 6), the circuit it protects, and the size, color, and pattern of the wire (or wires) which connect to the circuit breaker terminals.



1. OPEN
2. 10-Amp.
3. 10-Amp.
4. 5-Amp.
5. 10-Amp.
6. 10-Amp.
7. 8-Amp.
8. 8-Amp.
9. OPEN
10. OPEN
11. 10-Amp.
12. 8-Amp.
13. 5-Amp.
14. 5-Amp.
15. 5-Amp.
16. 5-Amp.
17. 8-Amp.
18. 8-Amp.
19. 10-Amp.
20. 8-Amp.
21. 5-Amp.
22. 5-Amp.
23. 5-Amp.
24. 5-Amp.
25. OPEN
26. OPEN
27. OPEN
28. OPEN
29. OPEN
30. OPEN
31. 8-Amp.
32. 8-Amp.

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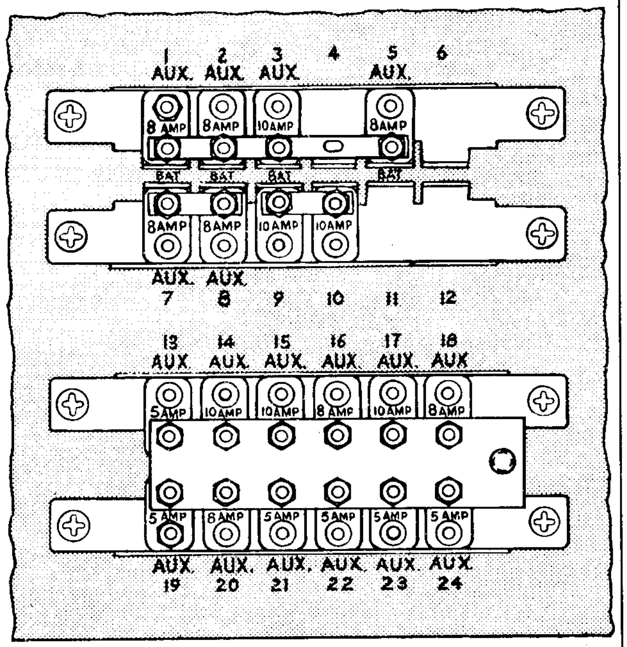
Figure 5—Driver's Control Panel Circuit Breakers (Model PD4108)



1. 8-Amp.
2. 8-Amp.
3. 10-Amp.
4. OPEN
5. 8-Amp.
6. OPEN
7. 8-Amp.
8. 8-Amp.
9. 10-Amp.
10. 10-Amp.
11. OPEN
12. OPEN
13. 5-Amp.
14. 10-Amp.
15. 10-Amp.
16. 8-Amp.
17. 10-Amp.
18. 8-Amp.
19. 5-Amp.
20. 8-Amp.
21. 5-Amp.
22. 5-Amp.
23. 5-Amp.
24. 5-Amp.

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Figure 6—Driver's Control Panel Circuit Breakers (Model PD4905)

DRIVER'S CONTROL PANEL CIRCUIT BREAKERS
(MODEL PD-4108)

C. B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
1	OPEN				
2	To Light Switch "OFF"	10A	16	Red	Battery
3	HEADLAMPS To Light Switch	10A	16	Red-Grn. Tr.	Battery
4	DRIVER'S LAMP AND SEAT LAMP* To Driver's Lamp Switch and Seat Lamp Switch*	5A	16	Nat.-Blk. Cr. Tr.	Battery
5	INTERIOR LAMPS SWITCH & RELAY To Interior Light Switches "GENERAL AND READING"	10A	16	Nat.-Red Tr.	Battery
6	MARKER AND NIGHT LAMPS To Main Light Switch	10A	16	Brn.-Red Tr.	Battery
7	DESTINATION SIGN To Destination Sign Switch.	8A	16	Brn.-Blk. & Nat. Cr. Tr.	Battery
8	BAGGAGE COMPARTMENT LAMPS To Intermediate Relay Panel Jct. 12 . . .	8A	16	Blk.-Red Tr.	Battery
9	OPEN				
10	OPEN				

* Special Equipment.

(Continued)

DRIVER'S CONTROL PANEL CIRCUIT BREAKERS (CONT'D.)
(MODEL PD-4108)

C. B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
11	DIRECTIONAL SIGNALS				
	To Line Connector To Directional Lamp Flasher	10A	16	Red	Battery
12	HORN				
	To Horn Relay Terminal No. 1	8A	14	Brn.	Battery
13	DRIVER'S FAN				
	To Driver's Fan Switch	5A	16	Yell.-Blu. Tr.	Battery
14	STOP LAMP AND DD3 BRAKE STOP LAMP RELAY				
	To DD3 Brake Stop Lamp RelayTerm. #1	5A	16	Red	Battery
	To Driver's Control Panel Junction 60	5A	16	Red	Battery
15	PASSENGER CHIME SIGNAL				
	To Passenger Chime	5A	16	Grn.-Red Ch.	Battery
16	RUN CONTROL SWITCH				
	To Engine Run Switch	5A	16	Grn.-2 Blk. // Tr.	Battery
17	LAVATORY*				
	From Spliced Connector From Engine Run Magnetic Switch	8A	12	Red-Yell. Tr.	Engine Run Magnetic Sw.
	To Driver's Control Panel Junction 38		16	Blu.-Nat. Cr. Tr.	
18	ENGINE RUN CONTROL				
	From Spliced Connector From Engine Run Magnetic Switch	8A	12	Red-Yell. Tr.	Eng. Run Mag. Sw.
	To Driver's Control Panel Junction 41		14	Grn.	
	To Low Coolant Indicator "BATT."		16	Grn.	
19	STARTER CONTROL & ALARM SYSTEMS				
	From Spliced Connector From Engine Run Magnetic Switch	8A	12	Red-Yell. Tr.	Eng. Run Mag. Sw.
	To Starter Switch		16	Grn.-Red Cr. Tr.	
20	FLASHING STEP LAMP				
	From Spliced Connector From Engine Run Magnetic Switch	8A	12	Red-Yell. Tr.	Eng. Run Mag. Sw.
	To Spliced Connector To Step Lamp Sw., Step Lamp Flasher, & Flashing Step Lamp Relay Terminal No. 2		16	Grn.	
21	L.H. HEADLAMP LOW BEAM				
	From Driver's Control Panel Junction 14	5A	16	Brn.-Grn. Tr.	Dimmer Sw.
	To L.H. Headlamp Low Beam Connector		16	Brn.-Blk. Tr.	
22	R.H. HEADLAMP LOW BEAM				
	From Driver's Control Panel Junction 14	5A	16	Brn.-Grn. Tr.	Dimmer Sw.
	To R.H. Headlamp Low Beam Connector		16	Brn.-Nat. Tr.	
23	L.H. HEADLAMP HI-BEAM				
	From Driver's Control Panel Junction 13	5A	16	Dk. Grn.	Dimmer Sw.
	To L.H. Headlamp Hi-Beam		16	Brn.-Blk. Cr. Tr.	
24	R.H. HEADLAMPS HIGH BEAM				
	From Driver's Control Panel Junction 13	5A	16	Brn.-Red Tr.	Dimmer Sw.
	To R.H. Headlamp High Beam Connector		16	Brn.-Nat. Cr. Tr.	
25	OPEN				
26	OPEN				
27	OPEN				
28	OPEN				
29	OPEN				
30	OPEN				
31	W/S DEFROSTER				
	From Generator Relay Terminal No. 2	8A	12	Yell.	Generator Relay
	To Defroster Switch "OFF"		16	Yell.	
32	HEAT AND AIR CONDITIONING				
	From Generator Relay Terminal No. 2	8A	12	Yell.	Generator Relay
	To Heat & Air Conditioning Sw. "OFF"		14	Yell.-Blk. Tr.	

* Special Equipment.

DRIVER'S CONTROL PANEL CIRCUIT BREAKERS
(MODEL PD-4905)

C. B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
1	LAVATORY*				
	From Engine Run Relay Terminal No. 2	8A	12	Red	
	To Driver's Control Panel Junction 38		16	Blu.-Nat. Cr. Tr.	Eng. Run Relay
2	ENGINE RUN CONTROLS				
	From Engine Run Relay Terminal 2	8A	12	Red	
	To Driver's Control Panel Junction 22		14	Grn.	Eng. Run Relay
	To Low Coolant Indicator "BATT."		16	Grn.	
3	STARTER CONTROLS AND ALARM				
	From Engine Run Relay Terminal No. 2	10A	12	Red	
	To Starter Switch		16	Grn.-Red Cr. Tr.	Eng. Run Relay
4	OPEN				
5	FLASHING STEP LAMP				
	From Engine Run Relay Terminal 2		12	Red	
	To Spliced Connector To Step Lamp Sw., Step Lamp Flasher "X" and Flashing Step Lamp Relay Terminal No. 2		16	Grn.	Eng. Run Relay
6	OPEN				
7	HEATING & AIR CONDITIONING				
	From Heating & Air Cond. Relay Term. 2	8A	12	Yell.	Generator Relay
	To Heat-Air Cond. Switch "OFF"		14	Yell.-Blk. Tr.	
8	WINDSHIELD DEFROSTER				
	From Heating & Air Cond. Relay Term. 2	8A	12	Yell.	Generator Relay
	To Defroster Switch "OFF"		16	Yell.	
	To Defroster Hi-Speed Cut-Out Relay Terminal No. 3		16	Yell.	
9	TAIL LAMPS				
	From Driver's Control Panel Bus Bar Battery Junction	10A	14	Red	Battery
	To Main Light Switch "OFF"		16	Red	
10	HEADLAMPS				
	To Main Light Switch "HEAD-TAIL"	10A	16	Red-Grn. Tr.	Battery
11	OPEN				
12	OPEN				
13	DRIVER'S FAN				
	To Driver's Fan Switch	5A	16	Yell.-Blu. Tr.	Battery
14	INTERIOR LIGHTING SWITCH & RELAYS				
	To Interior Light Switch "GENERAL-READING"	10A	16	Nat.-Red Tr.	Battery
15	MARKER LAMPS & NIGHT LAMPS				
	To Main Light Switch "OFF"	10A	16	Brn.-Red Tr.	Battery
16	DESTINATION SIGN				
	To Destination Sign Switch	8A	16	Brn.-Blk. & Nat. Cr. Tr.	Battery
17	DIRECTIONAL SIGNALS				
	To Directional Lamp Flasher Line Conn.	10A	16	Red	Battery
18	BAGGAGE COMPARTMENT LAMPS				
	To Regulator Panel Jct. 6R	8A	16	Blk.-Red Tr.	Battery
19	WHEELS*				
	Feed Circuit To Wheels Switch	5A	16	Or.	Battery
20	HORN				
	To Horn Relay Terminal No. 1 & No. 4	8A	14	Brn.	Battery
21	DRIVER'S LAMP & SEAT LAMP*				
	To Driver's Control Panel Junction 52	5A	16	Nat.-Blk. Cr. Tr.	Battery
	To Driver's Lamp Switch		16	Nat.-Blk. Cr. Tr.	
	To Seat Lamp Switch*		16	Nat.-Blk. Cr. Tr.	
22	STOP LAMP				
	To Driver's Control Panel Junction 60	5A	16	Red	Battery
	To DD3 Brake Stop Lamp Relay Term. 1		16	Red	
23	PASSENGER CHIME SIGNAL				
	To Passenger Chime	5A	16	Grn.-Red Ch.	Battery
24	RUN CONTROL SWITCH				
	Feed To Engine Run Switch	5A	16	Grn.-2 Blk. // Tr.	Battery

* Special Equipment.

ENGINE COMPARTMENT APPARATUS BOX

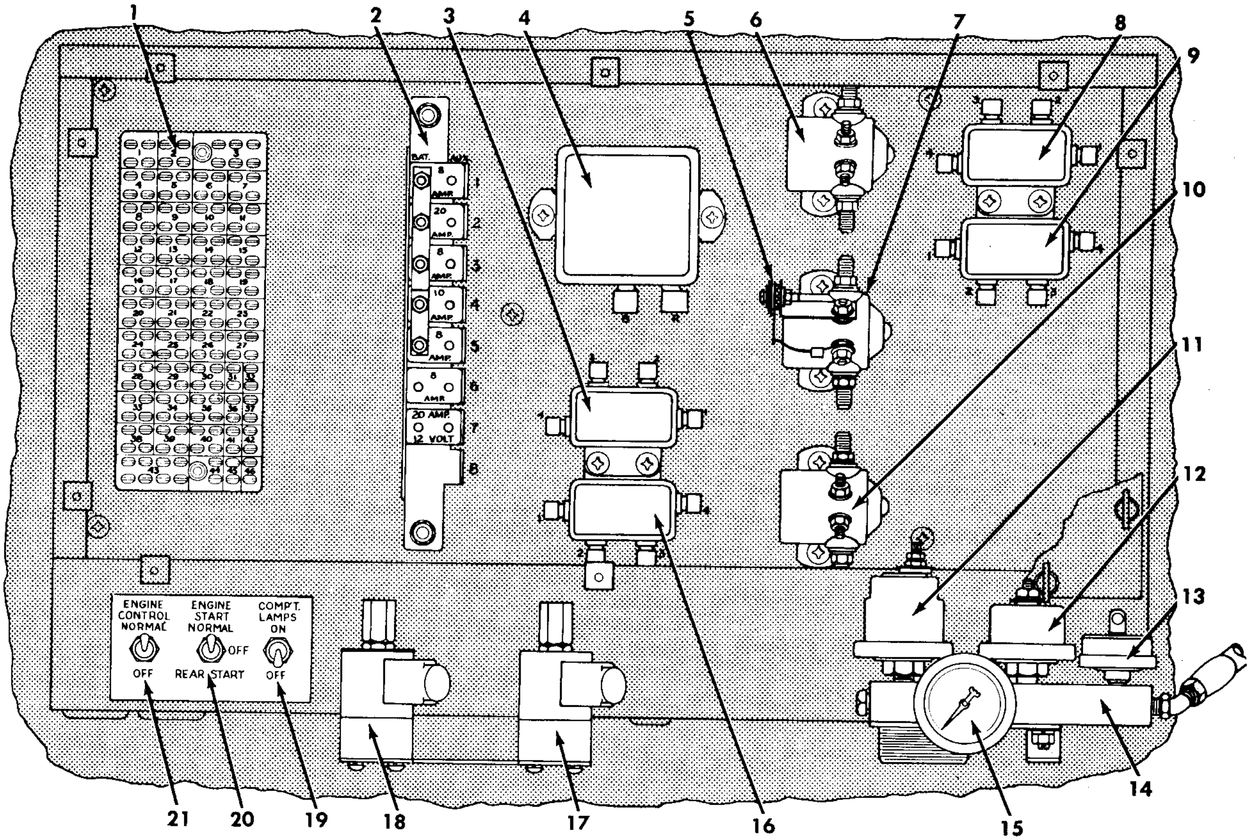
Engine compartment apparatus box (figs. 7 or 8) is located on the engine compartment bulkhead at upper left side. Access to components is attained by removing screws securing cover and lifting the cover from the box.

Components installed in the engine compartment apparatus box are identified in figure 7 for PD-4108 coach models or in figure 8 for PD-4905 coach models.

The junction panel used on PD-4108 model coaches (fig. 7) contains a 46 terminal junction block. Numbers on the junction block correspond to numbers shown on Wiring Diagrams and in the tabulation which follows.

The junction panel used on PD-4905 model coaches (fig. 8) contains 38 terminal posts, numbered consecutively from 1 through 38. Numbers on the junction panel correspond to numbers shown on Wiring Diagrams and in the tabulation which follows.

The tabulations which follow list each terminal number, the circuit it carries, and the size, color, and pattern of the wires which connect to each terminal. Some of the unused terminals, marked "OPEN" or "SPARE" in the tabulation, may be used



1 Junction Panel (46 Terminals)
2 Circuit Breaker Carrier, Bus Bar and Circuit Breakers
3 Engine Low Oil Relay
4 Starter Lockout Relay
5 Rectifier
6 Reverse Magnetic Switch
7 Starter Magnetic Switch
8 Air Conditioning Clutch Relay
9 Air Conditioning Clutch Holding Relay
10 Emergency Stop Magnetic Switch
11 Oil Pressure Sending Unit
12 Oil Pressure Switch (Air Conditioning)
13 Oil Pressure Switch
14 Oil Pressure Manifold Assy.
15 Oil Pressure Gauge
16 Hot Engine Relay
17 Engine Stop Solenoid
18 Engine Fast Idle Solenoid
19 Engine Compartment Lamp Switch
20 Engine Rear Start Switch
21 Engine Control Switch

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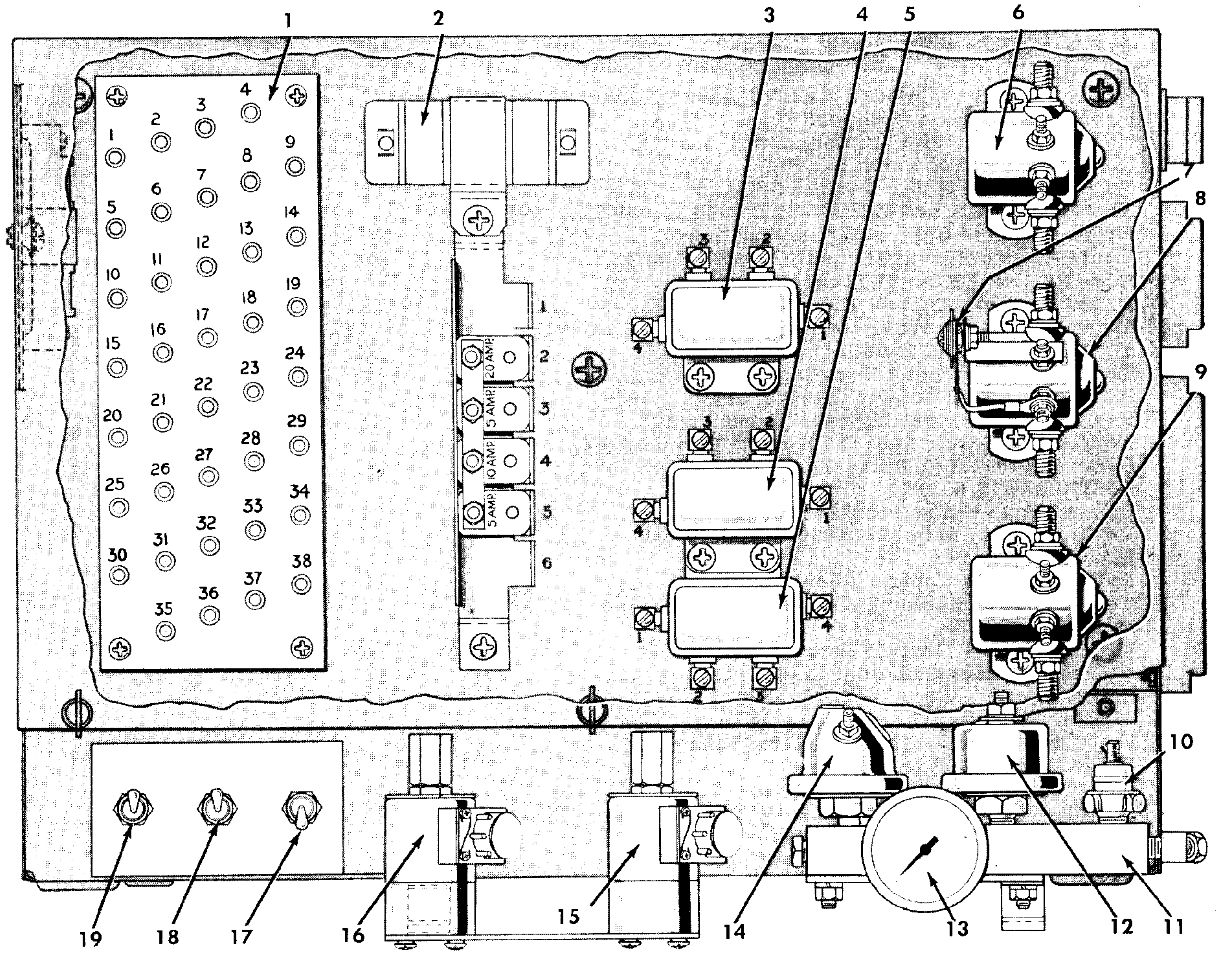
Figure 7—Engine Compartment Apparatus Panel (Model PD4108) (Typical)



1 Junction Panel (38 Terminals)
2 Circuit Breaker Carrier
3 Automatic Engine Stop Relay (Special Equipment)
4 Engine Low Oil Relay
5 Hot Engine Relay
6 Reverse Magnetic Switch
7 Rectifier
8 Starter Magnetic Switch
9 Emergency Stop Magnetic Switch
10 Oil Pressure Switch
11 Oil Pressure Manifold Assembly
12 Oil Pressure Switch (Air Conditioning)
13 Oil Pressure Gauge
14 Oil Pressure Sending Unit
15 Engine Stop Solenoid
16 Engine Fast Idle Solenoid
17 Engine Compartment Lamp Switch
18 Engine Rear Start Switch
19 Engine Control Switch T-5202

Figure 8—Engine Compartment Apparatus Panel (Model PD4905) (Typical)

for special electrical equipment. Terminal block numbers or terminal post numbers appear in the symbol ☐ on Wiring Diagrams.

NOTE: Wires leading from the junction panel into the engine compartment are covered with a special black heat-resistant insulation.

NOTE: Refer to Next Page For Engine Compartment Apparatus Box Junction Tabulation.

ENGINE COMPARTMENT APPARATUS BOX JUNCTIONS
(SYMBOL □) (MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
1	REAR START, LOW OIL RELAY AND ENGINE STOP RELAY*		
	From Rear Start Switch "OFF"	16	Grn.-Blk. Cr. Tr.
	To Hot Engine Relay Terminal No. 4	16	Grn.-Blk. Cr. Tr.
	To Low Oil Relay Terminal No. 4	16	Grn.-Blk. Cr. Tr.
	To Engine Stop Relay Terminal No. 3*	16	Grn.-Blk. Cr. Tr.
2	TRANSMISSION REVERSE SOLENOID MAGNETIC SWITCH		
	From Driver's Control Panel Junction 2	16	Blk.-2 Red // Tr.
	To Reverse Solenoid Magnetic Switch (Coil)	16	Blk.-2 Red // Tr.
3	ENGINE CONTROL SWITCH		
	From Driver's Control Panel Junction 41	16	Grn.
	To Engine Compartment Apparatus Box No. 6C.B.	16	Grn.
	To Engine Control Switch (Feed)	16	Grn.
	To Engine Stop Relay Terminal No. 1*	14	Grn.
4	HOT ENGINE AND LOW OIL RELAY		
	From Driver's Control Panel Junction 3	16	Grn.-Blk. Tr.
	To Hot Engine and Low Oil Relays Terminal No. 2	16	Grn.-Blk. Tr.
	From Engines Top Relay Terminal No. 4*	16	Grn.-Blk. Tr.
5	EMERGENCY STOP		
	From Driver's Control Panel Junction 5	16	Grn.-Red Ch.
	To Emergency Stop Magnetic Switch "Coil"	16	Grn.-Red Ch.
6	MARKER LAMPS		
	From Driver's Control Panel Junction 6	16	Brn.-Blk. Tr.
	To Spliced Connector To Rear Marker Lamps	14	Brn.-Blk. Tr.
7	SPEEDOMETER		
	From Driver's Control Panel Junction 7	16	Blk.-Nat. Tr.
	To Engine Amphenol Plug Cavity "N"	16	Blk.-Nat. Tr.
8	OPEN		
9	SPARE		
	From Driver's Control Panel Junction 9	16	Grn.-2 Red // Tr.
	FIRE DETECTORS*		
	From Driver's Control Panel Junction 9	16	Grn.-2 Red // Tr.
	To Engine Amphenol Plug Cavity D	16	Grn.-2 Red // Tr.
10	SPARE		
	To Driver's Control Panel Junction 10	16	Brn.
11	STOP LAMPS		
	From Driver's Control Panel Junction 11	16	Red-2 Nat. // Tr.
	To Spliced Connector To Stop Lamp Line Connectors	16	Red
12	AIR CONDITIONING HI-LO PRESSURE SWITCH AND TELL-TALE LAMP		
	From HI-LO Pressure Switch "N.O."	16	Yell.-Blk. Cr. Tr.
	To Driver's Control Panel Junction 46	16	Yell.-Blk. Cr. Tr.
13	TRANSMISSION OIL PRESSURE SWITCH		
	From Driver's Control Panel Junction 29	16	Blk.-Red Tr.
	To Connector To Transmission Low Oil Switch Resistor and Engine Amphenol Plug "O"	16	Blk.-Red Tr.
14	ENGINE ALARM - HOT ENGINE SWITCH		
	From Driver's Control Panel Junction 30	16	Grn.-2 Blk. // Tr.
	From Hot Engine Relay Terminal No. 3	16	Grn.-2 Blk. // Tr.
	To Engine Amphenol Plug Cavity "F"	16	Grn.-2 Blk. // Tr.
15	ENGINE COMPARTMENT LAMPS		
	From Engine Compartment Lamp Switch	16	Brn.
	To Engine Compartment Lamps	16	Blk.
16	BACK-UP LAMPS		
	From Engine Amphenol Plug Cavity "P"	16	Blk.
	To Spliced Connector To Back-Up Lamps	16	Lt. Grn.
17	SPEEDOMETER		
	From Driver's Control Panel Junction 17	16	Blk.-2 Nat. // Tr.
	To Engine Amphenol Plug Cavity "C"	16	Blk.-2 Nat. // Tr.
18	OPEN		
19	REAR STARTER SWITCH		
	From Driver's Control Panel Junction 19	16	Grn.-Blk. Tr.
	To Rear Starter Switch	16	Grn.-Blk. Tr.
20	TAIL LAMPS AND LICENSE LAMPS		
	From Driver's Control Panel Junction 20	16	Or.-2 Blk. // Tr.
	To Spliced Connector To Tail and License Lamps	16	Brn.

* Special Equipment.

(Continued)

ENGINE COMPARTMENT APPARATUS BOX JUNCTIONS (CONT'D.)
(SYMBOL ☐) (MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
21	R.H. REAR DIRECTIONAL LAMP		
	From Driver's Control Panel Junction 21	16	Red-2 Grn. // Tr.
	To Line Connector To R.H. Rear Directional Lamp	16	Dk. Green
22	L.H. REAR DIRECTIONAL LAMP		
	From Driver's Control Panel Junction 22	16	Red-Grn. Cr. Tr.
	To Line Connector To L.H. Rear Directional Lamp	16	Yell.
23	SPARE		
	To Driver's Control Panel Junction 23	16	Grn.-Red Tr.
	AUTOMATIC ENGINE STOP*		
	From Driver's Control Panel Junction 23	16	Grn.-Red Tr.
	To Engine Stop Relay Terminal No. 2	14	Grn.-Red Tr.
24	ENGINE ALARM - LOW OIL PRESSURE SWITCH		
	From Driver's Control Panel Junction 24	16	Grn.-2 Nat. // Tr.
	From Low Oil Relay Terminal No. 3	16	Grn.-2 Nat. // Tr.
	To Engine Low Oil Pressure Switch Resistor	16	Grn.-2 Nat. // Tr.
	To Low Oil Pressure Switch	16	Blk.
25	ENGINE CONTROL - FAST IDLE SOLENOID VALVE		
	From Driver's Control Panel Junction 25	16	Grn.-Nat. Tr.
	To Fast Idle Solenoid Valve "N.C." Terminal B	16	Blk.
26	SPARE		
	To Driver's Control Panel Junction 26	16	Blk.-2 Grn. // Tr.
27	SPARE		
	To Driver's Control Panel Junction 27	16	Blk.-Grn. Tr.
28	OPEN		
29	REAR START SWITCH		
	From Spliced Connector From Rear Start Switch	14	Grn.-Brn. Cr. Tr.
	To Driver's Control Panel Junction 43	14	Grn.-Brn. Cr. Tr.
30	OPEN		
31	OPEN		
32	ENGINE ALARM - OIL PRESSURE SENDING UNIT		
	From Driver's Control Panel Junction 4	16	Grn.-Nat. Cr. Tr.
	To Engine Oil Pressure Sending Unit	16	Blk.
33	OPEN		
34	OPEN		
35	AIR CONDITIONING CLUTCH RELAY		
	From HI-LO Pressure Switch "N.C."	16	Yell.-Red Tr.
	To A/C Clutch Relay and A/C Clutch Hold Relay Term. No.3	16	Yell.-Red Tr.
36	WATER PUMP SWITCH		
	From Engine Compartment No. 4 C.B.	16	Yell.
	To Water Pump Switch	16	Yell.
37	WATER PUMP SWITCH		
	From Spliced Connector From Blower Motor Apparatus Panel 8-Amp. C.B.	16	Yell.-Red Tr.
	To Water Pump Switch	16	Or.
38	LAVATORY*		
	From Lavatory Door Switch "COM."	16	Blue
	To Line Connector To Lavatory Relay Terminal No. 3	16	Blk.
39	GENERATOR		
	From Apparatus Box No. 7 C.B.	12	Maroon
	To Driver's Control Panel Junction 42	12	Maroon
40	OPEN		
41	LOW COOLANT PROBE		
	From Driver's Control Panel Junction 75	16	Blk.-Red Cr. Tr.
	To Low Coolant Probe	16	Blk.
42	ENGINE ALARM ENGINE TEMPERATURE		
	From Driver's Control Panel Junction 76	16	Grn.-Blk. Cr. Tr.
	To Engine Amphenol Plug Cavity "G"	16	Grn.-Blk. Cr. Tr.
		16	Blk.
43	GROUND		
44	OPEN		
45	AIR CONDITIONING OIL PRESSURE SWITCH "N.C."		
	From A/C Clutch Hold Relay Terminal No. 4	16	Yell.-Blk. Tr.
	To Oil Pressure Switch	16	Blk.
46	SPARE		
	To Intermediate Relay Panel Junction 3	16	Blk.-Red Cr. Tr.

* Special Equipment.

ENGINE COMPARTMENT APPARATUS BOX JUNCTIONS
(SYMBOL □) (MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1	REGULATOR SENSING RELAY		
	From Rear Starter Switch	16	Grn.-Blk. Cr. Tr.
	To Low Oil and Hot Engine Relays Terminal 4	16	Grn.-Blk. Cr. Tr.
	To Regulator Sensing Relay Terminal No.	16	Grn.-Blk. Cr. Tr.
	To Engine Stop Relay Terminal No. 3*	16	Grn.-Blk. Cr. Tr.
2	EMERGENCY STOP MAGNETIC SWITCH CONTROL		
	From Driver's Control Panel Junction 2	16	Grn.-Red Ch.
	To Emergency Stop Magnetic Switch "Coil"	16	Grn.-Red Ch.
3	TRANSMISSION REVERSE SOLENOID MAGNETIC SWITCH		
	From Driver's Control Panel Junction 3	16	Blk.-2 Red // Tr.
	To Reverse Solenoid Magnetic Switch "Coil"	16	Blk.-2 Red // Tr.
4	HOT ENGINE AND LOW OIL RELAYS		
	From Driver's Control Panel Junction 4	16	Brn.-Blk. Tr.
	From Engine Stop Relay Terminal No. 4*	16	Grn.-Blk. Tr.
	To Hot Engine and Low Oil Relays Terminal No. 2	16	Grn.-Blk. Tr.
5	ENGINE ALARM - OIL PRESSURE SENDING UNIT		
	From Driver's Control Panel Junction 5	16	Grn.-Nat. Cr. Tr.
	To Engine Oil Pressure Sending Unit	16	Blk. (P.V.C.)
6	MARKER LAMPS		
	From Driver's Control Panel Junction 6	16	Brn.-Blk. Tr.
	To Spliced Connector To Rear Marker Lamps	14	Brn.-Blk. Tr.
7	SPEEDOMETER		
	From Driver's Control Panel Junction 7	16	Blk. Nat. Tr.
	To Engine Harness Connector No. 10	16	Blk. (P.V.C.)
8	OPEN		
9	SPARE		
	To Driver's Control Panel Junction 9	18	Grn.-2 Red // Tr.
	FIRE DETECTORS*		
	From Driver's Control Panel Junction 9	18	Grn.-2 Red // Tr.
	To Engine Harness Connector Terminal No. 11	18	Blk. (P.V.C.)
10	SPARE		
	To Driver's Control Panel Auxiliary Junction A4	16	Brn.
11	STOP LAMPS		
	From Driver's Control Panel Junction 11	16	Red-2 Nat. // Tr.
	To six cavity Tail Lamp Connector	16	Red
12	OPEN		
13	TRANSMISSION OIL PRESSURE SWITCH		
	From Driver's Control Panel Junction 13	16	Blk.-Red Tr.
	From Transmission Low Oil Switch Resistor	16	Blk. (P.V.C.)
	To Engine Harness Connector Terminal No. 5	16	Blk. (P.V.C.)
14	ENGINE ALARM - HOT ENGINE SWITCH		
	From Driver's Control Panel Junction 14	16	Grn.-2 Blk. // Tr.
	From Hot Engine Relay Terminal No. 3	16	Grn.-2 Blk. // Tr.
	To Engine Harness Connector Cavity 6	16	Blk. (P.V.C.)
15	ENGINE ALARM - ENGINE TEMPERATURE		
	From Driver's Control Panel Junction 15	16	Grn.-Blk. Cr. Tr.
	To Engine Harness Connector Cavity No. 7	16	Blk. (P.V.C.)
16	BACK-UP LAMPS		
	From Engine Harness Connector Cavity No. 13	16	Blk. (P.V.C.)
	To Six Cavity Tail Lamp Connector	16	Blk. (P.V.C.)
17	SPEEDOMETER		
	From Driver's Control Panel Junction 17	16	Blk.-2 Nat. // Tr.
	To Engine Harness Connector Cavity No. 9	16	Blk. (P.V.C.)
18	OPEN		
19	REAR STARTER SWITCH		
	From Driver's Control Panel Junction 19	16	Brn.-Blk. Tr.
	To Rear Start Switch	16	Grn.-Blk. Tr.
20	TAIL LAMPS		
	From Driver's Control Panel Junction 20	16	Or.-2 Blk. // Tr.
	To Tail and License Lamp Six Cavity Connector	16	Brn.
21	R.H. REAR DIRECTIONAL LAMP		
	From Driver's Control Panel Junction 21	16	Red-2 Grn. // Tr.
	To Six Cavity Connector To R.H. Rear Directional Lamp	16	Dk. Grn.
22	ENGINE CONTROL SWITCH		
	From Driver's Control Panel Junction 22	16	Grn.

* Special Equipment.

(Continued)

ENGINE COMPARTMENT APPARATUS BOX JUNCTIONS (CONT'D.)
(SYMBOL ☐) (MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
22	ENGINE CONTROL SWITCH (CONT'D.)		
	From Engine Stop Relay Terminal No. 1*	14	Grn.
	To Engine Control Switch	16	Grn.
	To Engine Compartment Apparatus Box No. 5 C.B.	16	Grn.
23	AUTOMATIC ENGINE STOP*		
	From Driver's Control Panel Junction 23	16	Grn.-Red Tr.
	To Engine Control Switch	16	Grn.
	To Engine Stop Relay Terminal No. 2	14	Grn.-Red Tr.
24	ENGINE ALARM - LOW OIL PRESSURE SWITCH		
	From Driver's Control Panel Junction 24	16	Grn.-2 Nat. // Tr.
	From Low Oil Relay Terminal No. 3	16	Grn.-2 Nat. // Tr.
	From Engine Low Oil Pressure Switch Resistor	16	Grn.-2 Nat. // Tr.
	To Low Oil Pressure Switch	16	Blk.-(P.V.C.)
25	ENGINE CONTROL - FAST IDLE SOLENOID VALVE		
	From Driver's Control Panel Junction 25	16	Grn.-Nat. Tr.
	To N.C. Fast Idle Solenoid Valve	16	Blk. (P.V.C.)
26	OPEN		
27	SPARE		
	To Driver's Control Panel Junction 27	16	Blk.-Gr. Tr.
28	WATER PUMP SWITCH		
	From Engine Compartment No. 4 C.B.	16	Yell.
	To Water Pump Switch	18	Yell.
29	REAR STARTER SWITCH		
	From Driver's Control Panel Junction 29	14	Grn.-Brn. Cr. Tr.
	To Spliced Connector To Rear Start Switch	14	Grn.-Brn. Cr. Tr.
	To Engine Low Oil Pressure Switch Resistor	14	Grn.-Brn. Cr. Tr.
	To Trans. Low Oil Switch Resistor	14	Grn.-Brn. Cr. Tr.
30	LOW COOLANT		
	From Driver's Control Panel Junction 30	16	Blk.-Red Cr. Tr.
	To Low Coolant Probe	16	Blk.
31	L.H. REAR DIRECTIONAL LAMP		
	From Driver's Control Panel Junction 31	16	Red-Grn. Cr. Tr.
	To Cavity Connector To L.H. Rear Directional Lamp Line Connector	16	Yell.
32	ENGINE COMPARTMENT LAMPS		
	From Engine Compartment Lamp Switch	16	Brn.
	To Engine Compartment Lamps	16	Blk. (P.V.C.)
33	WATER PUMP SWITCH		
	From Regulator Panel Junction 2R	16	Yell.-Red Tr.
	To Water Pump Switch	16	Yell.-Red Tr.
34	SPARE		
	To Regulator and Apparatus Panel	16	Blk.-Red Cr. Tr.
35	GROUND - INTERMEDIATE AXLE SOLENOID	16	Blk.
36	OPEN		
37	SPARE		
	To Driver's Control Panel Junction 37	16	Blk.-2 Grn. // Tr.
38	AIR CONDITIONING OIL PRESSURE SWITCH		
	From A/C Clutch Solenoid Valve Connector	16	Yell.-Red Tr.
	To Oil Pressure Switch	14	Blk.

* Special Equipment.

ENGINE COMPARTMENT APPARATUS BOX

CIRCUIT BREAKERS

Circuit breaker carrier on engine compartment apparatus panel (fig. 7 or 8) has space for eight automatic reset type circuit breakers on PD-4108 model coach or six automatic-reset type circuit breakers on PD-4905 Model coach.

NOTE: Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

Circuit breaker numbers, shown on Wiring Diagrams and in the tabulations which follow, do not appear on the circuit breakers or on the panel. To identify the circuit breakers, refer to engine compartment apparatus panel shown in figure 7 or figure 8.

When replacing a circuit breaker, make sure the circuit breaker is of the same voltage and amperage rating. Make sure all terminal junctions are clean and tight.

ENGINE COMPARTMENT CIRCUIT BREAKER TABULATION
(MODEL PD-4108)

C.B. No.	Circuit	Volts	Amps.	Wire Size	Color Code	Fed From
1	AIR CONDITIONING CLUTCH RELAY.	24	8			Battery
	To A/C Clutch Relay Terminal No. 1			16	Yell.-Grn. Tr.	
2	TRANSMISSION	24	20			Battery
	To Reverse Solenoid Magnetic Switch			14	Blk.-Grn. Tr.	
3	ENGINE COMPARTMENT LAMPS	24	8			Battery
	To Engine Compartment Lamp Switch			16	Brn.	
4	WATER PUMP SWITCH	24	10			Battery
	To Engine Compartment Junction 36			16	Yell.	
5	LAVATORY*	24	8			Battery
	To Lavatory Relay Terminal No. 1			16	Blk.-Red Tr.	
6	BACK-UP LAMPS	24	8			Eng. Run Mag. Sw.
	To Engine Amphenol Plug Junction "L"			16	Blk.	
7	FREQUENCY RELAY & SPEEDOMETER	12	20			Gen. "R" Terminal
	To Engine Compartment Junction 39			12	Maroon	
8	OPEN					

* Special Equipment.

ENGINE COMPARTMENT CIRCUIT BREAKER TABULATION
(MODEL PD-4905)

C.B. No.	Circuit	Volts	Amps.	Wire Size	Color Code	Fed From
1	LAVATORY*	24	8			Battery
	To Lavatory Relay Terminal No. 1			16	Blk.	
2	TRANSMISSION	24	20			Battery
	To Reverse Solenoid Magnetic Switch			14	Blk.-Grn. Tr.	
3	ENGINE COMPARTMENT LAMPS	24	8			Battery
	To Engine Compartment Lamp Switch			16	Brn.	
4	WATER PUMP SWITCH	24	10			Battery
	To Engine Compartment Junction 28			16	Yell.	
5	BACK-UP LAMPS	24	8			Eng. Run Relay
	To Engine Amphenol Plug Junction 12.			16	Blk.	
6	SPEEDOMETER, LOW COOLANT INDICATOR AND HEADLAMPS	12	20			Gen. "R" Terminal
	To Driver's Control Panel Junction 41			12	Maroon	

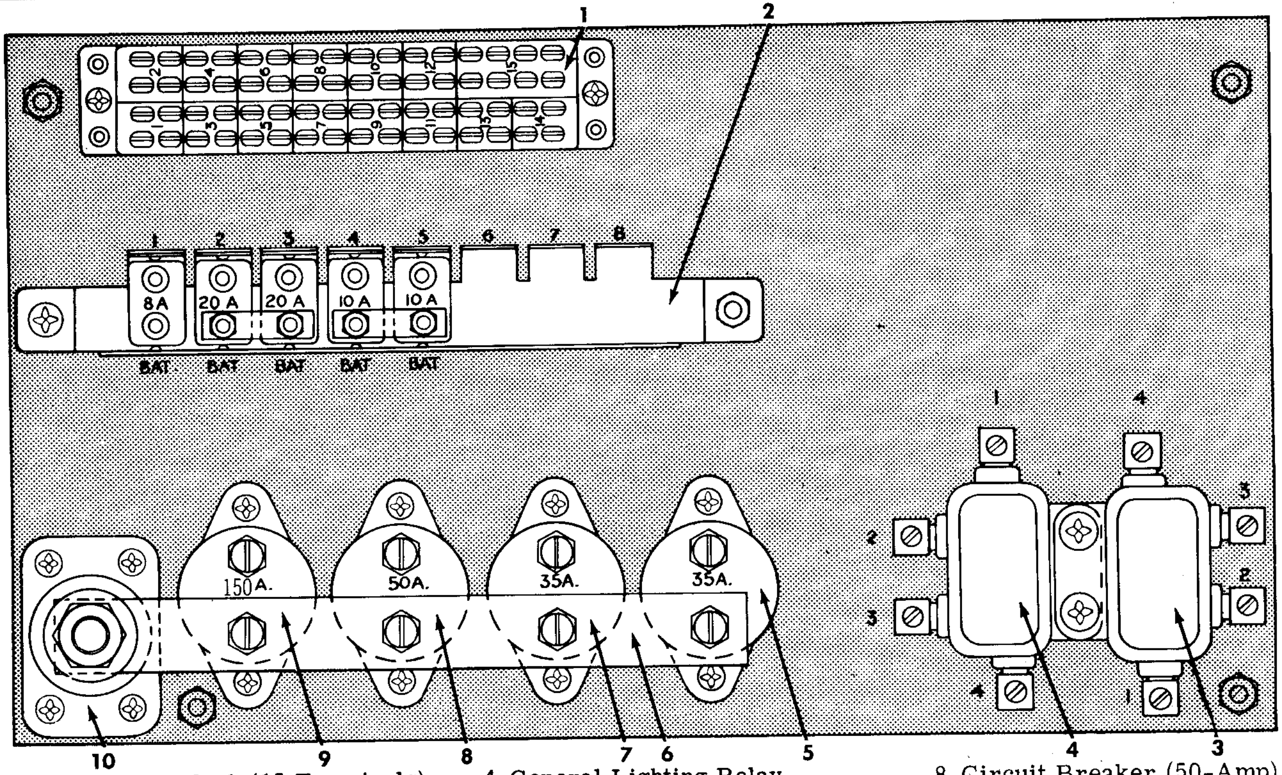
* Special Equipment.

INTERMEDIATE RELAY AND APPARATUS PANEL
(MODEL PD4108)

The intermediate relay and apparatus panel (fig. 9) is located on the front intermediate bulkhead plate. Components installed on the panel are shown in figure 9.

The apparatus panel contains a junction block providing 15 receptacles. Numbers on the junction block correspond to numbers on Wiring Diagrams and in the tabulation which follows.

The following tabulation lists each receptacle number, the circuit it carries, and the size, color, and pattern of the wire which connects to each terminal. Some of the unused terminals marked "OPEN" or "SPARE" in the tabulation, are available for use with additional special electrical equipment. Terminal block numbers appear in the symbol ⬡ on Wiring Diagrams.



1 Junction Block (15 Terminals)
2 Circuit Breaker Carrier and Circuit Breakers
3 Reading Lamp Relay
4 General Lighting Relay
5 Circuit Breaker (35-Amp)
6 Circuit Breaker Bus Bar
7 Circuit Breaker (35-Amp)
8 Circuit Breaker (50-Amp)
9 Circuit Breaker (150-Amp)
10 Battery Junction Block

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Figure 9—Intermediate Relay and Apparatus Panel (Model PD4108) (Typical)

INTERMEDIATE RELAY PANEL JUNCTIONS (SYMBOL ◇)
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
1	READING LAMP RELAY		
	From Driver's Control Panel Junction 34	16	Nat.-2 Blk. // Tr.
	To Reading Lamp Relay Terminal No. 3	16	Nat.-2 Blk. // Tr.
2	SPARE		
	To Driver's Control Panel Junction 70	16	Nat.-Blk. & Red // Tr.
3	SPARE		
	To Engine Compartment Junction 46	16	Blk.-Red Cr. Tr.
4	GENERAL LAMP RELAY		
	From Driver's Control Panel Junction 35	16	Nat.-Blk. Tr.
	To General Lamp Relay Terminal No. 3	16	Nat.-Blk. Tr.
5	NIGHT LAMPS AND MARKER LAMPS		
	From Driver's Control Panel Junction 6	16	Brn.-Blk. Tr.
	To Spliced Connector To Longitudinal Air Duct Junctions 3L and 3R	16	Brn.-Blk. Tr.
	To Line Connector To L.H. Rear Seat Night Lamp	16	Brn.-Blk. Tr.
6	SPARE		

(Continued)

INTERMEDIATE RELAY PANEL JUNCTIONS (SYMBOL ◇) (CONT'D.)
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
	To Intermediate Relay Panel Taped Spare	16	Grn.-Blk. Tr.
7	SPARE		
	To Driver's Control Panel Junction 54	14	Nat.
	REAR WHEEL SANDERS*		
	From Driver's Control Panel Junction 54	14	Nat.
	To Spliced Connector To Longitudinal Air Duct Junctions 6L and 6R	14	Nat.
8	OPEN		
9	SPARE		
	To Driver's Control Panel Junction 61	16	Yell.-Grn. Tr.
10	SPARE		
	To Driver's Control Panel Junction 51	16	Nat.-Blk. Cr. Tr.
	SEAT LAMPS*		
	From Driver's Control Panel Junction 51	16	Nat.-Blk. Cr. Tr.
	To Longitudinal Air Duct Junction 5L and 5R	16	Nat.-Blk. Cr. Tr.
11	BAGGAGE COMPARTMENT LAMPS, SWITCHES, AND FREON TANK LAMP		
	From Spliced Connector From Intermediate Relay Panel Junction 12	16	Blk.-Red Tr.
	To Freon Tank Lamp Line Connector	16	Blk.-Red Tr.
12	BAGGAGE COMPARTMENT LAMPS AND SWITCHES		
	From Driver's Control Panel No. 8 C.B.	16	Blk.-Red Tr.
	To Spliced Connectors To Baggage Compartment Lamps and Switches	16	Blk.-Red Tr.
	To Intermediate Relay Panel Junction 11	16	Blk.-Red. Tr.
13	OPEN		
14	SPARE		
	To Driver's Control Panel Junction 72	16	Yell.-Blue Tr.
15	GROUND	16	Blk.

INTERMEDIATE RELAY PANEL CIRCUIT BREAKERS (MODEL PD4108)

Circuit breakers mounted on intermediate relay apparatus panel on front intermediate bulkhead plate are shown in figure 9.

NOTE: Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

Circuit breaker numbers shown on Wiring Diagrams and in the tabulation which follows do not appear on the circuit breakers or on the panel; to identify the circuit breakers, refer to intermediate relay and apparatus panel assembly (fig. 9).

When replacing a circuit breaker, make sure the circuit breaker is of the same voltage and amperage rating. Make sure all terminal junctions are clean and tight.

The following tabulation lists each circuit breaker number (as identified in figure 9), the circuit it protects, and the size, color, and pattern of the wire (or wires) which connect to the circuit breaker terminals.

C.B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
1	LAVATORY*	8			Battery
	From Intermediate Relay & Junction Panel Hot Bus Bar "BAT."		16	Red	
	To Bolted Spliced Connector To Emergency Switch and Lavatory Switch "N.O."		16	Blu.-Blk. Tr.	
2	L.H. READING LAMPS	20			Reading Lamp Relay
	To Longitudinal Air Duct Junction 1L		12	Nat.-Red Tr.	
3	R.H. READING LAMPS	20			Reading Lamp Relay
	From Reading Lamp Relay Terminal No. 2		10	Nat.	
	To Longitudinal Air Duct Junction 1R		12	Nat.-Red Tr.	
4	GENERAL LIGHTING	10			General Lamp Relay
	From General Lamp Relay Terminal No. 2		12	Nat.-Red Tr.	
	To Longitudinal Air Duct Junction 2L		12	Nat.-Blk. Tr.	

(Continued)

C. B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
5	GENERAL LIGHTING	10			General Lamp Relay
	From General Lamp Relay Terminal No. 2 .		12	Nat.-Red Tr.	
	To Longitudinal Air Duct Junction 2R		12	Nat.-Blk. Tr.	
6	OPEN				
7	OPEN				
8	OPEN				

EVAPORATOR COMPARTMENT CIRCUIT BREAKERS (MODEL PD4108)

Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

The tabulation which follows lists each circuit breaker (as identified in figure 9), amperage rating, the circuit it protects, and the size, color, and pattern of the wire (or wires) which connect to each circuit breaker terminal.

Breaker Amperage		Wire Size	Color Code	Fed From
50-Amp.	Feed To Driver's Control Panel	6	Red	Battery
150 Amp.	Feed To Condenser Fan Magnetic Switch	2	Red	Battery
35-Amp.	To R.H. Blower Motor Magnetic Switch	6	Red	Battery
35-Amp.	To L.H. Blower Motor Magnetic Switch	6	Red	Battery

BATTERY COMPARTMENT CIRCUIT BREAKERS (MODEL PD4905)

Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

The tabulation which follows lists each circuit breaker installed in the battery compartment, the amperage rating, the circuit it protects, and the size, color, and pattern of the wire which connects to each circuit breaker terminal.

Breaker Amperage	Circuit	Wire Size	Color Code	Fed From
50-Amp.	Feed to Driver's Control Panel	6	Red	Battery
60-Amp.	Feed To Blower Motor Magnetic Switch	6	Red	Battery
	To Water Pump Relay Terminal No. 1	16	Red	
150 Amp.	Feed To Condenser Fan Magnetic Switch	2	Red	Battery

REGULATOR AND APPARATUS PANEL (MODEL PD4905)

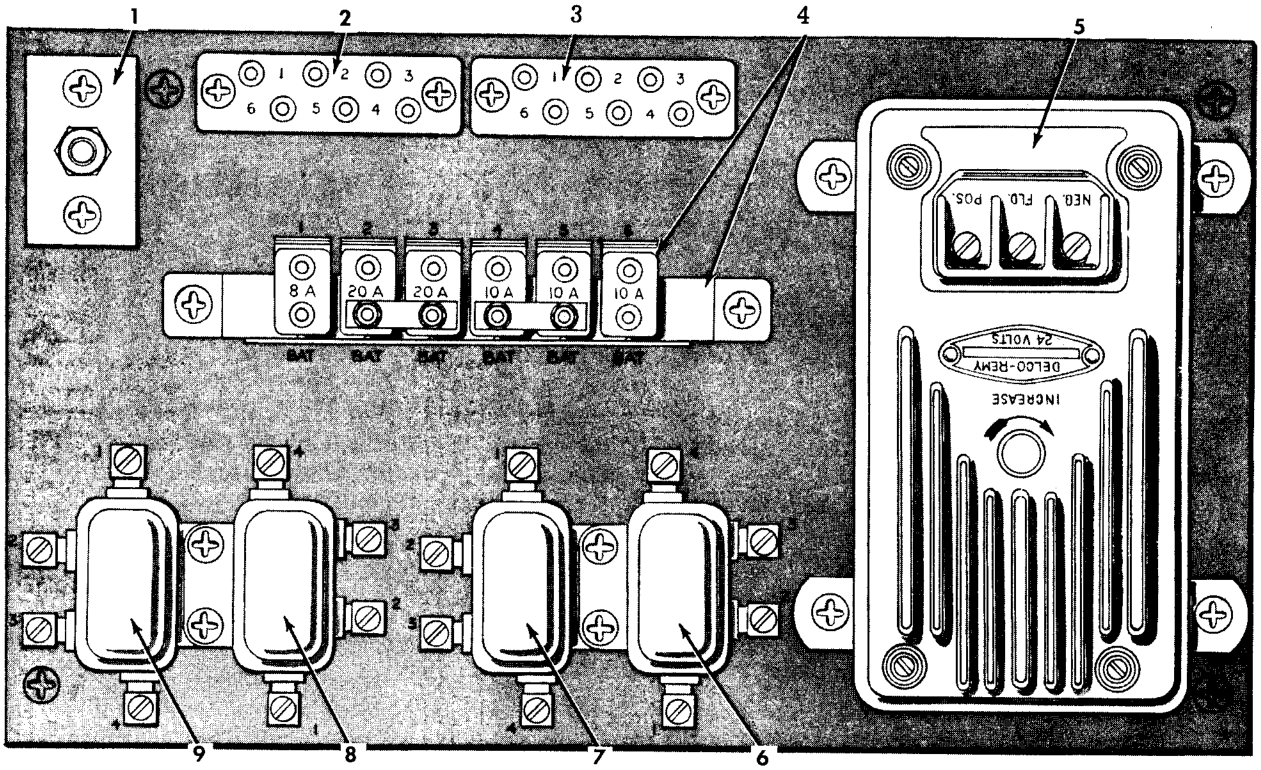
Regulator and apparatus panel (fig. 10) is located in right front baggage compartment. Access to components is attained by removing shield mounted on side of baggage compartment. Components installed on the regulator and apparatus panel are identified in figure 10.

The apparatus panel contains two six-terminal junction blocks. Each junction block is numbered from 1 through 6. Junction terminal numbers shown on Wiring Diagrams and in the tabulation appear on the junction blocks. The letters "L" and "R" used with the terminal numbers identify left and right junction blocks.

The following tabulation lists each terminal number, the circuit it carries, and the size, color, and pattern of wires which connect to the terminal. Some of the unused terminals, marked "OPEN" or "SPARE" in the tabulation may be used for special electrical equipment. Terminal post numbers on the junction blocks appear in the symbol ◯ on Wiring Diagrams in "Wiring Diagrams" booklet X-7014A.

Refer to Next Page For Regulator and Apparatus Panel Junctions.

WIRING AND MISC. ELECT.



1 Battery Junction Block
2 Left Junction Block
3 Right Junction Block
4 Circuit Breaker and Carrier
5 Voltage Regulator Assembly
6 Regulator Sensing Relay
7 Generator Relay
8 Reading Lamp Relay
9 General Lighting Relay

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Figure 10—Regulator and Apparatus Panel (Model PD4905)

REGULATOR AND APPARATUS PANEL JUNCTIONS
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1L	READING LAMPS		
	From Driver's Control Panel Junction 34	16	Nat.-2 Blk. // Tr.
	To Reading Lamp Relay Terminal No. 3	16	Nat.-2 Blk. // Tr.
2L	LAVATORY*		
	From Bolted Connector From Emergency Switch	16	Blue-Nat. Tr.
	To Driver's Control Panel Junction 39	16	Blue-Nat. Tr.
3L	LAVATORY*		
	From Driver's Control Panel Junction 38	16	Blue-Nat. Cr. Tr.
	To Bolted Connector To Lavatory Door Switch "N.C." . . .	16	Blue-Nat. Cr. Tr.
4L	GENERAL LAMP RELAY		
	From Driver's Control Panel Junction 35	16	Nat.-Blk. Tr.
	To General Lamp Relay Terminal No. 3	16	Nat.-Blk. Tr.
5L	NIGHT LAMPS		
	From Driver's Control Panel Junction 6 Spliced Connector .	16	Brn.-Blk. Tr.
	To Spliced Connector To Longitudinal Air Duct Junctions 3L and 3R	16	Brn.-Blk. Tr.
	To Line Connector To L.H. Rear Seat Night Lamp	16	Blk.-Red Tr. (P. & C.)
6L	AIR CONDITIONING RELAYS		
	From HI-LO Pressure Switch "M1," A/C Generator Field Relay Terminal 3, & A/C Generator Terminal 2 . .	16	Yell.-Blk. Cr. Tr.
	To Driver's Control Panel Junction 46 "A/C Tell-Tale" . . .	16	Yell.-Blk. Cr. Tr.

(Continued)

REGULATOR AND APPARATUS PANEL JUNCTIONS (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1R	SPARE		
	To Driver's Control Panel Junction 54	14	Nat.
	REAR WHEEL SANDER*		
	From Driver's Control Panel Junction 54	14	Nat.
	To Longitudinal Air Duct Junctions 6L and 6R	14	Nat.
2R	WATER PUMP MANUAL CONTROL		
	From Heating & Ventilation Compartment Blower Motor Apparatus Panel 8-Amp. C.B.	16	Yell.-Red Tr.
	To Engine Compartment Junction 33	16	Yell.-Red Tr.
3R	AIR CONDITIONING HI-LO PRESSURE SWITCH		
	From Spliced Connector From Driver's Control Panel Jct. 45	16	Yell.-Grn. Tr.
	To HI-LO Pressure Switch "L2" "L1"	16	Yell.-Grn. Tr.
4R	SEAT LAMP*		
	From Driver's Control Panel Junction 51	16	Nat.-Blk. Cr. Tr.
	To Longitudinal Air Duct Junctions 5L and 5R	16	Nat.-Blk. Cr. Tr.
5R	BAGGAGE COMPARTMENT LAMPS, SWITCHES, AND FREON TANK LAMP		
	To Line Connector To Freon Tank Lamp	16	Blk.-Brn. Tr. (P. & C.)
	To Baggage Compartment Lamps and Switches	16	Blk.-Brn. Tr.
6R	BAGGAGE COMPARTMENT LAMPS AND SWITCHES		
	From Driver's Control Panel No. 18 C.B.	16	Blk.-Red Tr.
	To Baggage Compartment Lamp Switches	16	Blk.-Red Tr.

* Special Equipment.

REGULATOR AND APPARATUS PANEL CIRCUIT BREAKERS
(MODEL PD4905)

Circuit breakers are accessible after removing shield mounted on right side of right front baggage compartment. Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

Circuit breaker numbers shown on Wiring Diagrams and in the tabulation which follows do not appear on circuit breakers or on the panel. To identify circuit breakers, refer to figure 10.

The following tabulation lists each circuit breaker number (as identified in fig. 10), the circuit it protects, and the size, color, and pattern of the wire (or wires) which connect to the circuit breaker terminal.

C. B. No.	Circuit	Amps.	Wire Size	Color Code	Fed From
1	LAVATORY*	8			Battery
	From Regulator and Apparatus Panel Bat. Jct.		16	Red	
	To Connectors To Emergency Switch and Lavatory Door Switch "N.O."		16	Blu.-Blk. Tr.	
2	L.H. READING LAMPS	20			Reading Lamp Relay
	From Reading Lamp Relay Terminal 2		10	Nat.	
	To Longitudinal Air Duct Junction 1L		12	Nat.-Red Tr.	
3	R.H. READING LAMPS	20			Reading Lamp Relay
	From Reading Lamp Relay Terminal 2		10	Nat.	
	To Longitudinal Air Duct Junction 1R		12	Nat.-Red Tr.	
4	GENERAL LIGHTING	10			General Lamp Relay
	From General Lamp Relay Terminal 2		12	Nat.-Red Tr.	
	To Longitudinal Air Duct Junction 2L		12	Nat.-Blk. Tr.	
5	GENERAL LIGHTING	10			General Lamp Relay
	From General Lamp Relay Terminal 2		12	Nat.-Red Tr.	
	To Longitudinal Air Duct Junction 2R		12	Nat.-Blk. Tr.	
6	GENERATOR	10			Generator Relay
	From Generator Relay Terminal 2		16	Gray	
	To Driver's Control Panel Junction 42		16	Gray	

*Special Equipment.

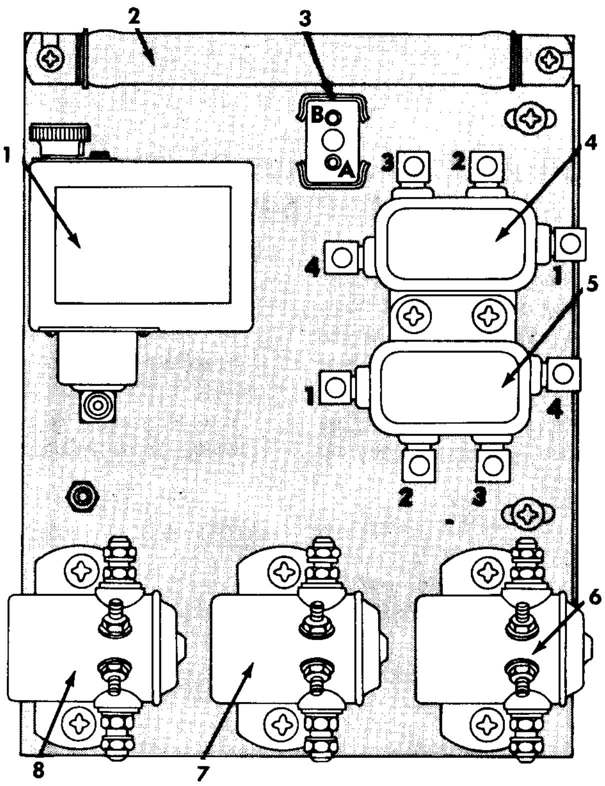
TOOL COMPARTMENT CIRCUIT BREAKERS
(MODEL PD4905)

Headlamp high and low beam circuits are protected by four 5-amp circuit breakers located in the tool compartment in left front corner of coach.

Operation of circuit breakers is described previously under "Driver's Control Panel Circuit Breakers."

The following tabulation lists each circuit breaker, the circuit it protects, and the size, color, and pattern of the wire (or wires) which connect to each circuit breaker terminal as shown on applicable Wiring Diagram in "Wiring Diagrams" booklet X-7014A.

C. B. No.	Circuit	Wire Size	Color Code	Fed From
1	L.H. HEADLAMP HIGH BEAM			
	From Driver's Control Panel Junction 32	16	Brn.-Blk. Tr.	Dimmer Switch
	To L.H. Headlamp High Beam Connector	16	Brn.-Blk. Tr.	Dimmer Switch
2	R.H. HEADLAMP HIGH BEAM			
	From Driver's Control Panel Junction 32	16	Brn.-Nat. Cr. Tr.	Dimmer Switch
	To R.H. Headlamp High Beam Connector	16	Brn.-Nat. Cr. Tr.	Dimmer Switch
3	R.H. HEADLAMP LOW BEAM			
	From Driver's Control Panel Auxiliary Jct. A6 .	16	Brn.-Grn. Tr.	Dimmer Switch
	To R.H. Headlamp Low Beam Connector	16	Brn.-Nat. Tr.	Dimmer Switch
4	L.H. HEADLAMP LOW BEAM			
	From Driver's Control Panel Auxiliary Jct. A6 .	16	Brn.-Grn. Tr.	Dimmer Switch
	To L.H. Headlamp Low Beam Connector	16	Brn.-Blk. Tr.	Dimmer Switch



1 Pressure Switch
2 Resistor
3 Circuit Breaker (8 Amp)
4 Water Pump Relay
5 Fan Hi-Speed Relay
6 R.H. Blower Motor Magnetic Switch
7 Condenser Fan Magnetic Switch
8 L.H. Blower Motor Magnetic Switch (PD-4108 Only)

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Figure 11—Ventilation Compartment Apparatus Panel (Typical)

VENTILATION COMPARTMENT APPARATUS PANEL (MODEL PD4108)

Ventilation compartment apparatus panel is located in ventilation compartment on lower right-hand air duct plate assembly. Components of the ventilation compartment apparatus panel are identified in figure 11.

An 8-amp circuit breaker installed on the apparatus panel is fed from No. 2 terminal on water pump relay. When "HEAT-AIR COND." switch is placed in "HEAT" position, current from the battery is supplied through relay operating coil causing normally open contacts to close. With points closed, current will flow from relay terminal No. 2 and circuit breaker to energize the water pump and water pump switch.

NOTE: For operation of circuit breaker, refer to "Driver's Control Panel Circuit Breakers."

REAR AXLE REAR BULKHEAD JUNCTION BLOCK (SYMBOL ○) (MODEL PD4905)

Rear axle rear bulkhead junction block mounted on rear axle rear bulkhead contains terminal posts numbered from 1 through 8. Numbers on block correspond to numbers on Wiring Diagrams and in the tabulation which follows: The tabulation lists each terminal number, the circuit it carries, and the size, color, and pattern of the wires which connect to the terminals. Terminal post numbers on junction block appear on Wiring Diagrams in symbol ○ in "Wiring Diagrams" booklet X-7014A.

Terminal No.	Circuit	Wire Size	Color Code
1	AIR CONDITIONING CONTROL RELAY		
	From Regulator and Apparatus Panel Junction 3R	14	Yell.-Grn. Tr.
	To A/C Control Relay Terminal No. 3	14	Yell.-Grn. Tr.
	To HI-LO Relay Terminal No. 4	14	Yell.-Grn. Tr.
2	HI-LOW PRESSURE SWITCH		
	From "HI-LO" Pressure Switch "M1"	16	Yell.-Blk. Cr. Tr.
	To Regulator and Apparatus Panel Junction 6L	16	Yell.-Blk. Cr. Tr.
3	GROUND		
	From A/C Clutch Relay Terminal No. 3	14	Blk.
	To Engine Compartment Junction 35	14	Blk.
4	AIR CONDITIONING CONTROL CLUTCH RELAYS, SOLENOID VALVE, AND OIL PRESSURE SWITCH		
	From Spliced Connector From A/C Control Relay Solenoid Valve	14	Yell.-Red Tr.
	From Spliced Conn. From A/C Control Relay Terminal No. 4	14	Yell.-Red Tr.
	To A/C Clutch Solenoid "N.C." and A/C Clutch Relay Terminal No. 1	14	Yell.-Red Tr.
	To Engine Compartment Junction 38	14	Yell.-Red Tr.
5	AIR CONDITIONING GENERATOR RELAY		
	From A/C Generator Relay Terminal No. 1	14	Blk.-Wht. Tr.
	To Regulator & Apparatus Panel No. 6 Circuit Breaker	14	Blk.-Wht. Tr.
6	AIR CONDITIONING CONTROL RELAY		
	From Air Cond. Control Relay Terminal No. 2	14	Nat.
	To Solenoid Valve	14	Nat.
7	OPEN		
8	OPEN		

LONGITUDINAL AIR DUCT JUNCTION BLOCKS

Two junction blocks contain terminal posts numbered from 1 through 6. Numbers on each junction block correspond to number on Wiring Diagrams and in the tabulation which follows. The letters "L" and "R" used with the terminal number identify left and right junction blocks.

The following tabulation lists each terminal number, the circuit it carries, and the size, color, and pattern of wires which connect to the terminal. Terminal post numbers on junction blocks appear on Wiring Diagrams in "Wiring Diagrams" booklet X-7014A in the symbol ○ .

Refer to Next Page For Junction Block Tabulation.

LONGITUDINAL AIR DUCT JUNCTION TABULATION
(MODEL PD-4108)

Terminal No.	Circuit	Wire Size	Color Code
1L	READING LAMPS		
	From Intermediate Relay and Junction Panel No. 2 Circuit Breaker	12	Nat.-Red Tr.
	To Bolted Connector To L.H. Reading Lamp Switch "F"	10	Red
2L	GENERAL LIGHTING		
	From Intermediate Relay and Junction Panel No. 4 Circuit Breaker	12	Nat.-Blk. Tr.
	To Spliced Connector To L.H. General Lamp	16	Nat.-Blk. Tr.
3L	CENTER MARKER LAMP		
	From Driver's Control Panel Junction 6	16	Brn.-Blk. Tr.
	From Intermediate Relay Panel Junction 5	16	Brn.-Blk. Tr.
	To Spliced Connector To Line Connectors To L.H. Center Marker Lamps and Rear Pkg. Rack-Night Lamp	16	Brn.-Blk. Tr.
4L	GROUND		
	From Bolted Connector From L.H. Reading Lamp "G"	12	Blk.
	To Ground	12	Blk.
5L	OPEN		
6L	OPEN		
1R	READING LAMPS		
	From Intermediate Relay Panel No. 3 Circuit Breaker	12	Nat.-Red Tr.
	To R.H. Reading Lamp Switch "F" Bolted Connector	12	Nat.-Red Tr.
2R	GENERAL LIGHTING		
	From Intermediate Relay & Jct. Panel No. 5 Circuit Breaker	12	Nat.-Blk. Tr.
	To Line Connector To R.H. General Lamp	12	Nat.-Blk. Tr.
3R	CENTER MARKER LAMP		
	From Spliced Connector From Intermediate Relay and Apparatus Panel Junction 3R	16	Brn.-Blk. Tr.
	To Line Connector To Center Marker Lamps and Front Package Rack Night Lamp	16	Brn.-Blk. Tr.
4R	GROUND		
	From Bolted Connector From R.H. Reading Lamp Sw. "G"	12	Blk.
	To Ground	12	Blk.
5R	OPEN		
6R	REAR WHEEL SANDERS*		
	From Intermediate Relay Panel Junction 7	14	Nat.

* Special Equipment.

LONGITUDINAL AIR DUCT JUNCTION TABULATION
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1L	From Regulator and Apparatus Panel No. 2 C.B.	12	Nat.-Red. Tr.
	To Bolted Connector To L.H. Reading Lamp Switch "F"	12	Nat.-Red Tr.
2L	GENERAL LIGHTING		
	From Regulator and Apparatus Panel No. 4 C.B.	12	Nat.-Blk. Tr.
	To Line Connector To L.H. General Lamp	16	Nat.-Blk. Tr.
3L	CENTER MARKER LAMP		
	From Spliced Connector From Regulator and Apparatus Panel Junction 5L	16	Brn.-Blk. Tr.
	To Line Connector To L.H. Rear Package Rack Night Lamp and Center Marker Lamps	16	Brn.-Blk. Tr.
4L	GROUND		
	From Bolted Connector From L.H. Reading Lamp Sw. "G".	12	Blk.
	To Ground	12	Blk.
5L	SEAT LAMPS*		
	From Regulator and Apparatus Panel Junction 4R	16	Nat.-Blk. Cr. Tr.
6L	REAR WHEEL SANDERS*		
	From Regulator and Apparatus Panel Junction 1R	14	Nat.

* Special Equipment.

(Continued)

LONGITUDINAL AIR DUCT JUNCTION TABULATION (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
1R	READING LAMPS		
	From Regulator and Apparatus Panel No. 3 C.B.	12	Nat.-Red Tr.
	To Bolted Connector To R.H. Reading Lamp Switch "F"	12	Nat.-Red Tr.
2R	GENERAL LIGHTING		
	From Regulator and Apparatus Panel No. 5 C.B.	12	Nat.-Blk. Tr.
	To Line Connector To R.H. General Lamp	12	Nat.-Blk. Tr.
3R	CENTER MARKER LAMP		
	From Regulator and Apparatus Panel Junction 5L	16	Brn.-Blk. Tr.
	To Spliced Connector To Front Package Rack Night Lamp and Center Marker Lamps	16	Brn.-Blk. Tr.
4R	GROUND		
	From Bolted Connector From R.H. Reading Lamp Sw. "G".	12	Blk.
5R	SEAT LAMPS*		
	From Regulator and Apparatus Panel Junction 4R	16	Nat.-Blk. Cr. Tr.
6R	REAR WHEEL SANDERS*		
	From Regulator and Apparatus Panel Junction 1R	14	Nat.

*Special Equipment.

AMPHENOL CONNECTORS

Wiring harness connections are made at several points on vehicle through amphenol multiple plug and receptacle type connectors. Terminals in receptacle and on plug are identified by letters or numbers. Locating key in receptacle housing engages a slot in plug to assure proper installation of plug. Letters or numbers on plugs and receptacles correspond to letters or numbers shown on Wiring Diagrams and in the tabulations which follow. Location of each amphenol connector, together with the symbols and circuit tabulations, follows:

ENGINE AMPHENOL CONNECTOR (MODEL PD4108)

Electrical connections between the terminals, circuit breakers and electrical units in engine compartment apparatus box and the engine wiring harness are made through a receptacle in engine compartment apparatus box. Refer to symbol ▢ on Wiring Diagrams in "Wiring Diagrams" booklet X-7014A.

Terminal Letter	Circuit	Wire Size	Color Code
A	A/C CLUTCH COMPRESSOR		
	From A/C Clutch Relay Terminal No. 2	16	Yell.-Blue Tr.
	To Compressor Clutch	16	Blk.
B	REVERSE SOLENOID MAGNETIC SWITCH		
	From Reverse Solenoid Magnetic Switch	14	Blk.
	To Reverse Solenoid	14	Blk.
C	SPEEDOMETER SENDING UNIT "O"		
	From Engine Compartment Apparatus Box Junction 17	16	Blk.-2 Nat. // Tr.
	To Speedometer Sending Unit "O"	16	Blk.
D	SPARE		
	To Engine Compartment Junction 9	16	Grn.-2 Red // Tr.
	FIRE DETECTORS*		
	From Engine Compartment Apparatus Box Junction 9	16	Grn.-2 Red // Tr.
	To Fire Detectors	16	Grn.-2 Red // Tr.
E	STARTER BATTERY - SOLENOID		
	From Starter Solenoid	10	Blk.
	To Engine Compartment Apparatus Box No. 4 C.B.	12	Grn.
F	HOT ENGINE SWITCH		
	From Engine Compartment Junction 14 and Hot Engine Relay Terminal No. 3	16	Grn.-2 Blk. // Tr.
	To Hot Engine Switch	16	Blk.
G	ENGINE TEMPERATURE SENDING UNIT		
	From Engine Compartment Junction 42	16	Grn.-Blk. Cr. Tr.
	To Engine Temperature Sending Unit	16	Blk.

(Continued)

*Special Equipment.

ENGINE AMPHENOL CONNECTORS (CONT'D.)
(MODEL PD-4108)

Terminal Letter	Circuit	Wire Size	Color Code
H	EMERGENCY STOP MAGNETIC SWITCH		
	From Emergency Stop Magnetic Switch	12	Blk.
	To Emergency Stop Solenoid	10	Blk.
J	STARTER SOLENOID - MAGNETIC SWITCH		
	From Starter Magnetic Switch	10	Blk.
	To Starter Solenoid "Coil"	10	Blk.
K	GENERATOR "R" TERMINAL		
	From Generator "R" Terminal	12	Blk.
	To Engine Compartment Apparatus Box No. 7 C. B.	12	Maroon
L	BACK-UP LAMPS - CIRCUIT BREAKER TO SWITCH		
	From Engine Compartment Apparatus Box No. 6 C.B.	16	Blk.
	To Back-Up Lamp Switch	16	Blk.
M	GROUND	10	Blk.
N	SPEEDOMETER SENDING UNIT "S"		
	From Engine Compartment Junction 7	16	Blk.-Nat. Tr.
	To Speedometer Sending Unit "S"	16	Blk.
O	TRANSMISSION OIL PRESSURE SWITCH		
	From Engine Compartment Junction 13	16	Blk.-Red Tr.
	To Transmission Oil Pressure Switch	16	Blk.
P	BACK-UP LAMPS - SWITCH TO LAMPS		
	From Back-up Lamp Switch	16	Blk.
	To Engine Compartment Junction 16	16	Blk.

* Special Equipment.

ENGINE AMPHENOL CONNECTOR
(MODEL PD4905)

Electrical connections between terminals, circuit breakers, and electrical units in engine compartment apparatus box and the engine wiring harness are made through a receptacle at right side of engine compartment apparatus box. Refer to symbol ⊡ on Wiring Diagrams.

Terminal No.	Circuit	Wire Size	Color Code
1	STARTER BATTERY - SOLENOID		
	From Starter Solenoid	10	Blk.
	To Engine Compartment Apparatus Box No. 4 C. B.	12	Blk.
2	REVERSE SOLENOID MAGNETIC SWITCH		
	From Reverse Solenoid Magnetic Switch	14	Blk.
	To Reverse Solenoid	10	Blk.
3	EMERGENCY STOP		
	From Emergency Stop Magnetic Switch	12	Blk.
	To Emergency Stop Solenoid	10	Blk.
4	STARTER SOLENOID - MAGNETIC SWITCH		
	From Starter Magnetic Switch	12	Blk.
	To Starter Solenoid	10	Blk.
5	TRANSMISSION OIL PRESSURE SWITCH		
	From Engine Compartment Apparatus Box Junction 13	16	Blk.
	To Transmission Oil Pressure Switch	16	Blk.
6	HOT ENGINE SWITCH		
	From Engine Compartment Apparatus Box Junction 14	16	Blk.
	To Hot Engine Switch	16	Blk.
7	ENGINE TEMPERATURE SENDING UNIT		
	From Engine Compartment Apparatus Box Junction 15	16	Blk.
	To Engine Temperature Sending Unit	16	Blk.
8	FUEL PRESSURE SWITCH - MAGNETIC SWITCH		
	From Starter Magnetic Switch	16	Blk.
	To Fuel Pressure Switch	16	Blk.
9	SPEEDOMETER SENDING UNIT - GROUND		
	From Engine Compartment Apparatus Box Junction 17	16	Blk.
	To Speedometer Sending Unit "O"	16	Blk.

(Continued)

ENGINE AMPHENOL CONNECTORS (CONT'D.)
(MODEL PD-4905)

Terminal No.	Circuit	Wire Size	Color Code
10	SPEEDOMETER SENDING UNIT		
	From Engine Compartment Apparatus Box Junction 7	16	Blk.
	To Speedometer Sending Unit "S"	16	Blk.
11	SPARE		
	To Engine Compartment Apparatus Box Junction 9	18	Blk.
	FIRE DETECTORS*		
	From Engine Compartment Apparatus Box Junction 9	18	Blk.
	To Fire Detectors	18	Blk.
12	BACK-UP LAMPS - CIRCUIT BREAKER TO SWITCH		
	From Engine Compartment Apparatus Box No. 5 Circuit Breaker	16	Blk.
	To Back-up Lamp Switch	16	Blk.
13	BACK-UP LAMPS - SWITCH TO LAMPS		
	From Back-up Lamp Switch	16	Blk.
	To Engine Compartment Apparatus Box Junction 16	16	Blk.
14	OPEN		

* Special Equipment.

ENGINE CLOSURE DOOR AMPHENOL CONNECTORS
(MODELS PD-4108 AND PD-4905)

Engine compartment closure door wiring harness, carrying circuits to lights on door, is connected to amphenol connector on rear body wiring harness assembly. Refer to symbol 🅅 on applicable wiring diagrams in "Wiring Diagrams" booklet X-7014A.

Circuit	Wire Size	Color Code
TAIL LICENSE LAMPS		
From Engine Compartment Apparatus Box Junction 20	16	Brn.
To Spliced Connector To Tail and License Lamps	16	Brn.
STOP LAMPS		
From Engine Compartment Apparatus Box Junction 11	16	Red
To Spliced Connector To L.H. and R.H. Stop Lamps	16	Red
R.H. REAR DIRECTIONAL LAMP		
From Engine Compartment Apparatus Box Junction 21	16	Dk. Grn.
To Line Connector To R.H. Rear Directional Lamp	16	Dk. Grn.
L.H. REAR DIRECTIONAL LAMP		
From Engine Compartment Apparatus Box Junction 31	16	Yell.
To Line Connector To L.H. Rear Directional Lamp		
GROUND		Blk.
BACK-UP LAMPS		
From Engine Compartment Apparatus Box Junction 16	16	Blk.
To Spliced Connector To Back-Up Lamps	16	Lt. Gr.

SPEEDOMETER AMPHENOL CONNECTOR

Wiring connections at speedometer head are made through amphenol connectors. Refer to the symbol 🄺 on Wiring Diagram in "Wiring Diagrams" booklet X-7014A.

Symbol	Circuit	Wire Size	Color Code
"+"	SPEEDOMETER HEAD FEED		
	Model PD-4108		
	From Driver's Control Panel Junction 42	16	Maroon
	Model PD-4905		
	From Driver's Control Panel Junction 41	16	Maroon
"-"	SPEEDOMETER HEAD GROUND		
	To Ground	16	Blk.
"S"	SPEEDOMETER SENDING UNIT		
	To Driver's Control Panel Junction 7	16	Blk.-Nat. Tr.
"O"	SPEEDOMETER SENDING UNIT		
	To Driver's Control Panel Junction 17	16	Blk.-2 Nat. // Tr.

BATTERY JUNCTIONS

Battery junctions are located in several places on the vehicle. Battery cables, carrying current to various parts of the vehicle for operation of electrical systems and units, are connected at these junctions. Connections must be kept clean and tight. If corroded, move battery disconnect switch, located in battery compartment, to "OFF" position; then disconnect cables and thoroughly clean cable ends and junction studs. Connect cables to junction studs, tighten stud nuts firmly, and move battery disconnect switch to "ON" position. Location of battery cable junctions are as follows:

MODEL PD-4108

1. Battery disconnect switch is located in battery compartment at left rear of coach. When switch is placed in "OFF" position, batteries are disconnected from the entire electrical system.

2. The intermediate relay and apparatus panel battery junction (fig. 9), located on the right front intermediate bulkhead plate is accessible from inside the baggage compartment.

3. Driver's control panel battery junction, located at bottom of junction panel at left of driver (fig. 3), is accessible after the junction panel cover is removed.

MODEL PD-4905

1. Battery disconnect switch is located in battery compartment. When switch is placed in "OFF" position, batteries are disconnected from the entire electrical system.

2. The battery compartment junction block, mounted on right front intermediate bulkhead, is accessible from inside the battery compartment.

3. The regulator and apparatus panel battery junction (fig. 10), located on regulator and apparatus panel in right front baggage compartment is accessible after removing cover from regulator and apparatus panel.

4. Driver's control panel battery junction located on junction panel at left of driver (fig. 4) is accessible after junction panel cover is removed.

TELL-TALE ALARM SYSTEM

Tell-tale lights are located on tell-tale panel above gauge panel in front of driver. Red, green, and blue tell-tale lenses are used to indicate various conditions. Tell-tale identification is etched on name plate below each tell-tale as shown in figure 1. Each tell-tale lamp assembly is retained in the instrument cluster with a spring retainer.

Following is a list of tell-tale lights with a brief description of their purpose and a reference to the Wiring Diagram on which the circuit is shown.

1. "WATER" tell-tale (red), interconnected with the alarm buzzer, indicates that temperature of the engine is too high for safe operation. Engine should be stopped immediately and the over-heated condition corrected. Circuit is shown on "Alarm and Signal Wiring Diagram." Refer to "NOTE" following Step 2 below.

2. "LOW OIL." The red, low oil tell-tale, interconnected with the alarm buzzer, indicates that the engine lubricating oil pressure is below 3 psi. If tell-tale illuminates and buzzer sounds during operation, stop engine immediately and correct the cause of low oil pressure. Electrical circuit is shown on "Alarm and Signal Wiring Diagram." Refer to "Note" following:

NOTE: On vehicles equipped with special automatic engine shut-off system, the "WATER" and "LOW OIL" tell-tale circuits are interconnected with a safety control relay which automatically shuts off the engine when either one of these abnormal conditions occur.

This condition can be overruled by placing "OVERRULE" switch, located on left switch panel, in "ON" position. Operation of Automatic Engine Stop System is described later in this section.

3. "LOW AIR." The red low air tell-tale interconnected with the alarm buzzer, indicates that air pressure is below 55-60 psi. This pressure will not efficiently operate brakes and air suspension system. If tell-tale illuminates and buzzer sounds during operation, stop the vehicle as soon as possible and correct the cause of low air pressure before proceeding. Refer to "Alarm and Signal Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

4. "TRANS. OIL." The red, transmission oil tell-tale indicates low oil pressure in the transmission. Electrical circuits and connections are shown on "Transmission Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

5. "STOP LAMP." The red, stop lamp tell-tale illuminates when brakes are applied to indicate normal operation of stop lights. If tell-tale does not illuminate when brakes are applied, it is an indication that one or both stop light bulbs are burned out. Refer to "Alarm and Signal Wiring Diagram" in X-7014A.

6. "A/C STOP." The red, air conditioning stop tell-tale will illuminate when the refrigerant "HI-LO" pressure switch contacts are open, indicating

that the compressor drive clutch is disengaged. Refer to "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

7. "HI-BEAM." The blue, hi-beam tell-tale illuminates when headlight high beam is being used.

8. "DIRECT. SIG." The green, directional signal tell-tale, located at each end of the "tell-tale" lamp cluster, flash on and off when directional signals are being used to indicate normal operation of signals. Failure of tell-tale lamp to illuminate indicates a burned out directional signal lamp or a defective flasher unit. Electrical circuits are shown on "Stop and Directional Light Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

ALARM BUZZER ASSEMBLIES

HOT ENGINE, LOW OIL, AND LOW AIR ALARM BUZZERS

Alarm buzzer assemblies are mounted in the driver's control panel junction box at left of driver (figs. 3 and 4). Tell-tale lamps for "HOT ENG." and "LOW OIL" are interconnected with alarm buzzer, and tell-tale lamp for "LOW AIR" is interconnected with alarm buzzer. Circuits can be checked for continuity, referring to "Alarm and Signal Wiring Diagram." The "Engine" switch must be in "RUN" position to energize the circuits. When checking circuits, sending unit switches must be grounded. If buzzer is defective, replace unit.

LAVATORY EMERGENCY ALARM BUZZER

Alarm buzzer is mounted under left side of instrument panel. Buzzer is operated by a push button type switch, marked "TO SIGNAL DRIVER - EMERGENCY ONLY," located on transverse partition of lavatory compartment. Refer to "Lavatory Wiring Diagram" in booklet X-7014A for wiring connections and circuits. When checking circuit for continuity, the "ENGINE" switch must be in the "RUN" position to energize system and switch in lavatory compartment must be grounded. If buzzer is found to be defective, replace unit.

ALARM AND SIGNAL SWITCHES

Low oil pressure switch, engine overheat thermostat, transmission oil, air conditioning stop and low air pressure switch are covered in other sections of this manual as previously indicated under "Index of Electrical Units."

STOP LIGHT, DIRECTIONAL SIGNAL AND HEADLIGHT DIMMER SWITCHES

Tell-tale lamps for stop lights, directional signals and headlight high beams are connected directly to switches which control individual circuits. Refer to "LIGHTING SYSTEM" later in this section for maintenance and location of switches.

ENGINE AUTOMATIC SHUT-OFF SYSTEM

The air-operated injector shut-off system stops the engine when "ENGINE" switch is in "STOP" position. Operation and maintenance of this system is covered in "DIESEL ENGINE" (SEC. 8) of this supplement.

On some coaches, an automatic engine shut-off relay system is used in conjunction with the air-operated injector shut-off system. This system is used in conjunction with the low oil pressure and hot engine tell-tale alarm system and the air-operated injector shut-off system to automatically stop the engine when a low oil pressure or hot engine condition occurs. Low oil and hot engine tell-tale circuits are mounted in the Driver's Control Panel (figs. 3 and 4). Hot engine, low oil, and engine stop relays are mounted in Engine Compartment Apparatus Panel (figs. 6 and 7). These units are connected into the electrical system as shown on "Engine Control and Generator" and "Alarm and Signal" wiring diagrams in "Wiring Diagrams" booklet X-7014A.

The engine stop relay, with points normally closed, is fed from the engine run magnetic switch on PD-4108 coach models or from the engine run relay on PD-4905 coach models. Current for energizing the engine stop solenoid valve, which must be energized while the engine is running, is fed through normally closed points of engine stop relay. Relay operating coil is connected to low oil pressure and hot engine relays.

When low oil pressure switch or hot engine switch contacts close, circuit is completed through low oil relay or hot engine relay to engine stop relay operating coil. With relay operating coil energized, relay contacts open, breaking circuit to engine stop solenoid valve. With solenoid valve de-energized, air pressure is admitted to engine shut-off air cylinder. Action of air cylinder on engine governor moves injector racks to "NO-FUEL" position, stopping the engine.

AUTOMATIC ENGINE SHUT-OFF SYSTEM TEST

Start engine and run for a few minutes to build up air pressure in system. Ground the engine overheat thermostat terminal to complete the circuit through the hot engine relay and engine stop relay operating coil. Engine stop solenoid valve should open and admit air to engine shut-off air cylinder on governor, moving the injector racks to "NO-FUEL" position, thus shutting off the engine. If engine does not stop, check operation of engine stop solenoid valve and air cylinder before condemning the engine stop relay. Refer to "Relays" described later in this section.

ENGINE "STOP OVERRULE" SWITCH

Coaches equipped with automatic engine shut-off system also have an overrule switch, located at top left of driver's instrument panel. Overrule switch is a momentary-on type switch. This switch must be held in for "ON" position and returns to "OFF" position when released. Purpose of switch is to feed current to the engine stop solenoid valve, overruling the engine stop relay. This permits starting the engine and moving the coach to safety in case the shut-off system shuts off the engine.

Electrical connections for "Stop Overrule" switch are shown on "Engine Control and Generator" Wiring Diagram.

RELAYS

Relays are used in some instances to automatically open or close a circuit as operating conditions may require; in other cases they are used to provide a direct connection between the battery and an electrically operated device, with only a small amount of current required to energize the relay operating coil. The latter use eliminates the use of great lengths of heavy wire, thereby providing higher voltage to the electrical device. Several of the same type relays are used on each vehicle.

Location, operation, and adjustment of the various relays used on the PD-4108 and PD-4905 coach models are described later under individual headings. Refer to applicable Wiring Diagrams for relay circuits.

The following tabulation lists each relay used, its location on the vehicle, and its part number. After determining part number of relay, refer to instructions under that part number for operation and adjustment.

		PD-4108	PD-4905
A/C Clutch Control	A/C Compressor Compartment (SEC. 26)	1116964	1116964
A/C Clutch Hold	Engine Compartment Apparatus Panel (Fig. 7)	1116964	——
A/C Condenser Fan "HI-SPEED"	Ventilation Compartment (Fig. 11)	1115860	1115860
Automatic Engine Stop	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	1115860	1115860
Blower Motor	Ventilation Compartment (Fig. 11)	——	672758
Blower Motor L.H.	Ventilation Compartment (Fig. 11)	672758	——
Blower Motor R.H.	Ventilation Compartment (Fig. 11)	672758	——
Condenser Fan	Ventilation Compartment (Fig. 11)	672758	——
DD3 Brake Stop Lamp	Driver's Control Panel (Fig. 3 or 4)	1116964	1116964
Defroster Hi-Speed Cut-Out	Driver's Control Panel (Fig. 4)	——	1115861
Defroster Low Speed	Driver's Control Panel (Fig. 4)	——	1115860
Emergency Stop	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	001481	001481
Engine Run Control	Driver's Control Panel (Fig. 4)	——	1116964
Engine Run Control	Driver's Control Panel (Fig. 3)	572758	——
Engine Stop Time Delay*	Engine Compartment Apparatus Panel (Fig. 8)	——	656841
Flashing Step Lamp	Under Dash Right-Hand Side	1115861	1115861
Frequency Sensing	Engine Compartment Apparatus Panel (Fig. 7)	1115871	——
General Lamp	Intermediate Relay & Apparatus Panel (Fig. 9)	1116964	——
General Lamp	Regulator & Apparatus Panel (Fig. 10)	——	1116964
Generator Control	Driver's Control Panel (Fig. 3 or 4)	1116969	1116969
Generator No-Charge*	Driver's Control Panel (Fig. 4)	——	1115860
Heating and Air Conditioning	Driver's Control Panel (Fig. 4)	——	1116964
Horn	Driver's Control Panel (Fig. 3 or 4)	1116964	1116964
Hot Engine	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	1116964	1116964
Lavatory	On Heat Exchange or Support	1116964	1116964
Low Oil	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	1116964	1116964
Reading Lamp	Intermediate Relay & Apparatus Panel (Fig. 9)	1116964	——
Reading Lamp	Regulator & Apparatus Panel (Fig. 10)	——	1116964
Regulator Sensing	Regulator & Apparatus Panel (Fig. 10)	——	1116964
Reverse Solenoid	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	001481	001481
Starter	Engine Comp't. Apparatus Panel (Fig. 7 or 8)	001481	001481
Stop Lamp	Driver's Control Panel (Fig. 3 or 4)	658311	658311
Watch Step Lamp	Driver's Control Panel (Fig. 3 or 4)	1115861	1115861
Water Pump	Ventilation Compartment (Fig. 11)	1116964	1116964

*Special

RELAY 001481 (MAGNETIC SWITCH)

Several of these relays are used on the PD-4108 and PD-4905 coach models as indicated under "Relay Tabulation" previously. Location and function of each relay is described under an individual heading.

EMERGENCY STOP RELAY
(MODEL PD-4108 AND PD-4905)

The emergency stop relay is mounted on engine compartment apparatus panel (fig. 7 or 8). Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Emergency stop relay "BAT." terminal is fed from bus bar in engine compartment apparatus box at No. 3 circuit breaker. Relay operating coil is energized by emergency stop switch on instrument panel in front of driver. When relay operating coil is energized, relay points close, completing circuit from battery to emergency stop solenoid which controls a choke valve to restrict engine air intake.

REVERSE RELAY
(MODELS PD-4108 AND PD-4905)

The reverse relay is mounted on engine compartment apparatus panel (fig. 7 or 8). Electrical circuits and connections are shown on "Transmission Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Reverse relay "BAT." terminal is fed from No. 2 (20-Amp) circuit breaker in engine compartment apparatus box. Relay operating coil is energized from reverse switch on left switch panel in front of driver. When relay operating coil is energized, relay points close to complete circuit from battery to reverse solenoid mounted on transmission to permit engagement of reverse shift fork.

STARTER RELAY
(MODELS PD-4108 AND PD-4905)

Starter relay is mounted on engine compartment apparatus panel (fig. 7 or 8). Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram."

On PD-4108 coach model, relay "BAT." terminal is fed from engine compartment apparatus box bus bar at No. 2 (20 Amp) circuit breaker. Relay operating coil is energized by starter switch located on left switch panel in front of driver. When operating coil circuit is completed, relay points close, and circuit is completed from battery to operating coil of the engine starter solenoid. Ground for relay operating coil is routed through contacts of the frequency control relay.

When engine is started, current from generator "AC" terminal will flow through frequency control relay coil windings. With windings energized, contacts will open to break ground circuit to starter control relay operating coil. With starter control relay operating coil de-energized, contacts will open to break feed circuit to starter solenoid. A rectifier, mounted on starter relay, prevents excessive arcing at contacts of frequency control relay.

On PD-4905 coach models, starter relay "BAT" terminal is fed from bus bar on engine compartment apparatus box at No. 2 (20-Amp) circuit breaker. Relay operating coil is energized by the starter switch on left switch panel in front of the driver. When relay operating coil is energized, points close to complete circuit from battery to engine starter solenoid coil winding. Ground for relay operating coil is routed through fuel pressure switch contacts which are closed only when engine is not running. When engine starts and fuel pressure switch contacts open, relay operating coil is de-energized, breaking circuit to starter solenoid. A rectifier, mounted on starter relay, prevents excessive arcing at fuel pressure switch contacts.

RELAY ADJUSTMENT

This relay (magnetic switch) is a sealed unit and is not adjustable or repairable. If relay fails to operate within limits listed in "Specifications" at end of this section, replace the relay.

RELAY 572758 (MAGNETIC SWITCH)

ENGINE RUN CONTROL
(MODEL PD-4108)

Engine run relay is mounted on driver's control and apparatus panel at left of driver (fig. 3). Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "BAT." terminal is fed from driver's control panel battery junction. Relay operating coil is energized from "RUN" position of engine "RUN" switch. When operating coil circuit is completed, relay points close, completing circuit from battery to driver's control panel bus bar which supplies current to Starter switch, Air Brake switch, Low Coolant Indicator, Engine Controls and Overrule switch.

This relay is non-adjustable or repairable. If relay fails to function properly, replace the unit.

RELAY 656841

ENGINE STOP TIME DELAY
(MODEL PD-4905)

The engine stop time delay relay, used as special equipment on some coaches, is mounted on the engine compartment apparatus panel (fig. 8). Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "COM" terminal is fed through engine compartment junction 22 from driver's control panel No. 2 (8 Amp) circuit breaker. When engine is started, current is supplied from relay "COM" terminal through normally closed contact points to energize engine stop solenoid valve coil windings. Relay operating coil windings are connected in series with engine compartment apparatus panel junction No. 4 and junction No. 1. When hot engine or low oil switch contacts are closed by an abnormal operating condition, current will flow through relay coil windings to ground at hot engine or low oil switch. With relay windings energized, contacts will open to de-energize the engine stop solenoid valve and admit air to engine shut-off air cylinder to stop the engine.

Action of the time-delay relay is not immediate as it requires approximately 20 seconds for the unit to open the contacts.

This relay is non-adjustable or repairable. If relay fails to function properly, replace the unit.

RELAY 658311

STOP LAMP RELAY
(MODEL PD-4108 AND PD-4905)

The stop lamp relay is mounted on driver's control and apparatus panel at left of driver (fig. 3 or 4). Electrical circuits and connections are shown on "Alarm and Signal Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Stop lamp relay coil winding is fed from stop lamp switch. When brakes are applied and stop lamp switch contacts close, current from driver's control panel No. 14 circuit breaker (PD-4108 coach models) or No. 22 circuit breaker (PD-4905 coach models) will energize stop lamp relay coil winding. With windings energized, armature is attracted to core and relay points close, completing circuit to stop lamps and "STOP LAMP" tell-tale on tell-tale panel in front of driver, thus indicating stop lights are illuminated.

Stop lamp relay is sensitive to amperage, requiring the current draw of both stop lamp bulbs to close the points. If one bulb is burned out, current draw will not be sufficient to close relay points, and "STOP LAMP" tell-tale will not illuminate when brakes are applied.

The stop lamp relay is not adjustable or repairable; therefore, if relay fails to function properly, replace the unit.

RELAY 672758 (MAGNETIC SWITCH)

BLOWER MOTOR RELAY
(MOTOR PD-4905)

The blower motor relay (magnetic switch) is mounted on the Ventilation Compartment Apparatus Panel (fig. 11). Electrical circuits and connections are shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "BAT." terminal is fed from 60-Amp circuit breaker on battery compartment hot bus bar. When "HEAT-AIR COND." switch is placed in "AIR COND." position, current from driver's control panel No. 7 circuit breaker is supplied through relay operating coil windings to ground through the blower motors. With windings energized, contacts close to complete circuit to blower motors.

BLOWER MOTOR RELAYS
(MODEL PD-4108)

Two blower motor relays (magnetic switches) are mounted on the Ventilation Compartment Apparatus Panel (fig. 11). Electrical circuits and connections are shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

The left and right blower motor relay "BAT." terminals are fed from 35 Amp circuit breakers on Intermediate Relay and Apparatus Panel (fig. 9).

When "HEAT-AIR COND." switch is placed in "HEAT" or "AIR COND." position, current from driver's control panel No. 32 circuit breaker is supplied through operating coil windings of left and right blower motor relays to ground through the blower motors. With windings energized, contact points close to complete circuit to left and right blower motors.

CONDENSER FAN RELAY
(MODEL PD-4108)

The condenser fan relay (magnetic switch) is mounted on the Ventilation Compartment Apparatus Panel (fig. 11). Electrical circuits and connections are shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

The relay (magnetic switch) "BAT." terminal is fed from a 150-Amp circuit breaker on Intermediate Relay and Apparatus Panel (fig. 9).

When "HEAT-AIR COND." switch is placed in "AIR COND." position, current is supplied through relay operating coil windings causing contacts to close. Current will then flow through relay contact points to energize the condenser fan motor.

RELAY ADJUSTMENTS

These relays (magnetic switches) are sealed units and are not adjustable or repairable. If relay fails to function properly, replace the unit.

RELAY 1115860

Several of these relays are used on the PD-4108 and PD-4905 coach models as indicated under "Relay Tabulation" previously. Location and function of each relay is described under an individual heading following.

AIR CONDITIONING CONDENSER FAN HI-SPEED RELAY
(MODELS PD-4108 AND PD-4905)

This relay is mounted on the ventilation compartment apparatus panel (fig. 11). Relay connections and circuits are shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

This relay is used to energize the condenser fan "Hi-Speed" circuit when heating and air conditioning switch is in "AIR COND." position.

Relay operating coil is fed through the "Hi-Speed" pressure switch. When pressure in system is sufficient to close "Hi-Speed" pressure switch, current from driver's control panel No. 32 or No. 7 circuit breaker will pass through hi-speed pressure switch contacts to energize relay operating coil. With coil energized, contacts open to break circuit from "F" terminal on fan motor to ground forcing current through the 3.1 ohm resistor, thus causing condenser fan to operate at high speed.

AUTOMATIC ENGINE STOP RELAY
(MODEL PD-4108 AND PD-4905)

This relay, used in the automatic engine shut-off system (when specified) is mounted on engine compartment apparatus panel (fig. 7 or 8). Relay connections and circuits are shown on "Master Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

On PD-4108 coach models, relay "BAT." No. 1 terminal is fed through engine compartment junction 3 from driver's control panel No. 18 circuit breaker (8-Amp). When engine is started, current is supplied from relay terminal No. 1 through normally closed contact points and out terminal No. 2 to engine compartment junction 23.

On PD-4905 coach models, relay "BAT." No. 1 terminal is fed through engine compartment junction 22 from driver's control panel No. 2 circuit breaker (8-Amp). When engine is started, current is supplied from relay terminal No. 1 through normally closed contact points and out terminal No. 2 to energize engine stop solenoid valve coil windings.

On PD-4108 and PD-4905 coach models, relay terminal No. 4 is fed from engine compartment apparatus panel junction No. 4. Relay terminal No. 3 is connected to hot engine and low oil relays through engine compartment apparatus box junction 1. When the hot engine or low oil switch contacts are closed by an abnormal operating condition, current will flow through relay coil winding terminal No. 4 and out terminal No. 3 to ground at hot engine or low oil switch. With relay winding energized, relay contacts will open to de-energize the engine stop solenoid valve and admit air to engine shut-off air cylinder to stop the engine.

DEFROSTER LOW SPEED RELAY
(MODEL PD4905)

This relay is mounted on driver's control and apparatus panel (fig. 4). Relay connections and circuits are shown on "Heating and Air Conditioning Wiring Diagram" in booklet X-7014A.

This relay is used to energize defroster fans when heating and air conditioning switch is in "AIR COND." position. Low-speed relay terminal No. 1 is fed through coil winding of defroster hi-speed cut-out relay. With heating and air conditioning switch in "AIR COND." position, current will flow through low-speed relay contact points and out terminal No. 2 to ground to energize hi-speed relay operating coil. Current will then flow through hi-speed relay terminal No. 1 to operate defroster fans at full speed.

GENERATOR NO-CHARGE RELAY
(MODEL PD-4905)

This relay (when specified) is mounted on driver's control panel at left of driver (fig. 4). Relay connections and circuits are shown on "No-Charge Tell-Tale Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "BAT." terminal No. 1 is fed through the "No-Charge" tell-tale lamp from the engine control switch. When engine control switch is placed in "RUN" position, current will flow through the "NO-CHARGE" tell-tale lamp and relay normally closed contact points to ground through relay terminal No. 2 causing tell-tale lamp to illuminate.

When engine is started, current from generator "R" terminal will energize generator relay operating coil windings causing relay points to close. Current from the battery will then flow through generator relay terminal No. 1 and out terminal No. 2 to feed No. 6 circuit breaker on regulator and apparatus panel and "NO-CHARGE" relay terminal No. 3. Current will then flow through operating coil windings to ground through terminal No. 4. With windings energized, the normally closed contact points will open to break circuit to "NO-CHARGE" tell-tale lamp causing lamp to go out.

RELAY ADJUSTMENTS

This relay is a sealed unit and is not adjustable or repairable. If relay fails to operate within limits listed in "Specifications," replace the unit.

RELAY 1115861

Several of these relays are used on PD-4108 or PD-4905 coach models as indicated in "Relay Tabulation" previously. Location and function of each relay is described under individual headings as follows.

DEFROSTER HI-SPEED CUT-OUT RELAY (MODEL PD-4905)

This relay is mounted on driver's control and apparatus panel at left of driver (fig. 4). Refer to "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Relay terminal No. 1 is fed through the defroster fan motors when defroster switch is in "HI" position. With defroster switch in "HI" position, current will flow through driver's control panel junction No. 47 to energize "low-speed" relay operating coil winding causing normally closed contact points to open. Current from driver's control panel junction No. 47 will then feed through the defroster fan motors and driver's control panel junction No. 48 to "hi-speed" cut-out relay terminal No. 1. Current from terminal No. 1 will flow through the normally closed relay contact points and out terminal No. 2 to ground on the defroster switch to complete the "hi-speed" fan motor circuit.

Relay terminal No. 5 is fed from "A/C" side of the heating and air conditioning switch and normally open contact points. Terminal No. 3 is fed from driver's control panel No. 8 circuit breaker. When heating and air conditioning switch is placed in "AIR COND." position, current will flow through relay operating coil and normally closed contact points of the defroster "low-speed" relay to energize "hi-speed" cut-out relay coil windings. With "hi-speed" cut-out relay coil windings energized, normally open contact points will close and current will flow from terminal No. 3 through terminal No. 1 to energize the defroster fan motors.

FLASHING STEP LAMP RELAY (MODELS PD-4108 AND PD-4905)

This relay is used in the watch step sign, watch step aisle lamp (if used) and night lamp flasher electrical circuits. Relay is mounted under dash panel on right-hand heater and defroster panel. Refer to applicable "Flashing Step Lamp Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Relay terminal No. 1 is connected to watch step sign lamps, night lamp on second left-hand seat, and watch step aisle lamp (if used). Terminal No. 2 is fed from driver's control panel No. 20 circuit breaker on the PD-4108 model coach or from No. 5 circuit breaker on the PD-4905 model coach and completes circuit to illuminate the watch step sign, seat lamp, and watch step aisle lamps (when used) from the engine run switch.

Relay coil, terminal No. 4 is fed through step lamp switch when entrance door is open. When relay operating coil is energized, circuit is completed through the flasher and relay terminal No. 3 and No. 1 to flash the watch step sign lamps, night lamp and watch step aisle lamps (if used).

RELAY TEST

Connect a voltmeter parallel with relay operating coil (Nos. 4 and 5 terminals). Connect a variable resistance unit between No. 5 terminal and ground. Place engine "RUN" switch in "RUN" position. Slowly decrease resistance until relay activates and note reading on voltmeter. If opening voltage is not within limits listed in "Specifications" at end of this section, replace the relay.

RELAY 1115871

STARTER AUTOMATIC DISENGAGEMENT AND LOCKOUT (MODEL PD-4108)

The frequency control relay is mounted on the engine compartment apparatus panel as shown in figure 7. Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Frequency control relay "R" terminal is fed from generator "AC" terminal when engine is running.

When "STARTER" switch is placed in "START" position, current from driver's control panel No. 19 circuit breaker will flow through starter switch and starter control (Magnetic) switch operating coil to ground through the normally closed contacts within the frequency control relay.

When engine is started, current from generator "AC" terminal will flow through frequency control relay capacitor and operating coil causing relay contacts to open, thus breaking ground circuit to starter magnetic control switch.

NOTE: The capacitor and resistor within the relay determine at what frequency contacts will open.

RELAY 1116964

Several of these relays are used on each coach as indicated in "Relay Tabulation" previously. Location and function of each relay is described under an individual heading. Relay test instructions apply to all units.

AIR CONDITIONING CLUTCH RELAY (MODEL PD-4108)

This relay is mounted on the engine compartment apparatus panel as shown in figure 7. Refer to applicable "Heating and Air Conditioning Wiring

Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Relay operating coil terminal No. 3 is energized through the normally closed "N.C. contact points of the "HI-LO" pressure switch when heating and air conditioning switch is in "AIR COND." position.

When heating and air conditioning switch is placed in "AIR COND." position, current will flow through "HI-LO" pressure switch to ground at oil pressure switch through operating coil of the clutch hold relay. Current will then flow through clutch relay operating coil terminal No. 3 and out terminal No. 4 to ground through clutch hold relay contact points at No. 2 terminal causing the normally open clutch relay contact points to close. Current from No. 1 circuit breaker on engine compartment apparatus panel will flow through clutch relay terminal No. 1 and out terminal No. 2 to complete circuit to the compressor clutch.

AIR CONDITIONING CLUTCH RELAY (MODEL PD-4905)

This relay is mounted on bulkhead in air conditioning compressor compartment (SEC. 26, fig. 4). Refer to applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay operating coil (terminal No. 4) is energized through heating and air conditioning switch when switch is in "AIR COND." position and air pressure is above 65 psi.

When low air pressure switch contacts close, current will flow through clutch relay coil windings (terminal No. 4) and out terminal No. 3) to ground through the oil pressure switch. Relay terminals No. 3 and No. 1 are connected by a jumper lead. With windings energized, relay contact points will close to complete ground circuit for low air switch and air conditioning clutch solenoid valve after low oil pressure switch contacts open.

AIR CONDITIONING CLUTCH HOLD RELAY (MODEL PD-4108)

This relay is mounted on the engine compartment apparatus panel as shown in figure 7. Refer to applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

This relay is used to energize the air conditioning clutch relay operating coil circuit after the oil pressure switch contacts open. Relay operating coil (terminal No. 3) is fed from the "N.C." terminal of the "HI-LO" pressure switch when heating and air conditioning switch is in "AIR COND." position. Current from "HI-LO" pressure switch is fed through relay terminal No. 3 and operating coil to ground at oil pressure switch through relay terminal No. 4, thus causing contact points to close. Current from clutch relay terminal No. 4 will flow through clutch hold relay contact points (terminal No. 1) and out terminal No. 2 to complete circuit to the compressor clutch.

DD3 BRAKE STOP LAMP RELAY (MODELS PD-4108 AND PD-4905)

This relay is mounted on the driver's control and apparatus panel at left of driver (fig. 3 or 4). Refer to applicable "Alarm and Signal Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

This relay is connected into the stop lamp circuit in such a manner that when air brake switch is activated the normally open switch contacts will close to energize the relay operating coil winding. With winding energized, armature is attracted to core and contacts will close to energize the stop lamp relay coil windings and complete circuit to stop lamps and stop lamp tell-tale.

ENGINE RUN CONTROL RELAY (MODEL PD-4905)

This relay is mounted on driver's control and apparatus panel at left of driver as shown in figure 4. Electrical circuits and connections are shown on "Engine Control and Generator Wiring Diagram" and "Alarm and Signal Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "BAT." (No. 1) terminal is fed from battery junction on driver's control panel bus bar. Operating coil (No. 3) terminal is connected to "RUN" side of engine "RUN" switch. When switch is placed in "RUN" position, current is supplied from battery terminal on driver's control panel bus bar through operating coil of relay to ground terminal (No. 4). Contacts will close to complete circuit to driver's control panel bus bar circuit breakers Nos. 1, 2, 3, and 5.

GENERAL LAMP RELAY (MODELS PD-4108 AND PD-4905)

On PD-4108 model coach, this relay is mounted on the intermediate relay and apparatus panel as shown in figure 9. On PD-4905 model coach, this relay is mounted on the regulator and apparatus panel on front intermediate bulkhead as shown in figure 10. Electrical circuits and connections are shown on applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

General lamp relay "BAT." (No. 1) terminal is fed from battery junction on intermediate relay and apparatus panel or regulator and apparatus panel. Relay operating coil is energized from "GENERAL" position of the interior light switch. When operating coil circuit is completed, relay points close to complete circuit to general lamps through No. 4 and No. 5 circuit breakers on intermediate relay and apparatus panel or regulator and apparatus panel.

HEAT AND AIR CONDITIONING RELAY (MODEL PD-4905)

The heat and air conditioning relay is mounted on driver's control and apparatus panel at left of driver (fig. 4). Refer to "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

This relay is used to provide a connection between the battery and the heating and air conditioning switch when engine is running. Relay "BAT." (No. 1) terminal is fed from driver's control panel battery junction. Relay operating coil (No. 3) terminal is fed from generator relay (mounted on regulator and apparatus panel) through No. 6 circuit breaker on regulator and apparatus panel when engine is running.

When engine is started, current from generator "R" terminal will energize coil winding of generator relay. With windings energized, contacts will close to energize operating coil windings of heat and air conditioning relay, mounted on driver's control and apparatus panel. With windings energized, contacts will close to feed the heating and air conditioning switch.

HORN RELAY
(MODELS PD-4108 AND PD-4905)

This relay, used in the horn circuit, is mounted on driver's control and apparatus panel at left of driver (fig. 3 or 4). Refer to applicable "Alarm and Signal Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Coil windings of relay (terminals Nos. 3 and 4) are connected in series with the horn button. When horn button is pressed, circuit through relay winding is completed and armature is attracted to core. This completes circuit from No. 1 terminal through closed points and No. 2 terminal to horn.

HOT ENGINE AND LOW OIL RELAYS
(MODELS PD-4108 AND PD-4905)

These relays, used in the automatic engine stop circuit, and the hot engine and low oil pressure alarm circuits, are mounted on engine compartment apparatus panel (fig. 7 or 8). Relay connections and circuits are shown on applicable "Alarm and Signal Wiring Diagram" and "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Operating coils of each relay are fed from the battery through relay terminal No. 4. Operating coils of each relay are grounded through the corresponding sensing switch located on the engine. When either sensing switch closes, caused by a hot engine or low oil condition, circuit is completed through operating coils which close the relay contact points. Contact points of each relay (terminal No. 2) are connected in series with the hot engine or low oil alarm buzzer and the automatic engine stop circuit.

LAVATORY RELAY
(MODELS PD-4108 AND PD-4905)

This relay is mounted on the ventilation compartment apparatus panel as shown in figure 11. Electrical circuits and connections are shown on applicable "Lavatory Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Relay "BAT." (terminal No. 1) is fed through No. 5 circuit breaker on engine compartment apparatus panel on PD-4108 model coach or through No. 1 circuit breaker on PD-4905 model coach. Relay operating coil (terminal No. 3) is energized through the lavatory door switch when door is locked from the inside. When relay operating coil is energized, contact points will close to complete circuit from battery to fluorescent mirror lamp and heater (if used).

READING LAMP RELAY
(MODELS PD-4108 AND PD-4905)

On PD-4108 model coach, this relay is mounted on the intermediate relay and apparatus panel as shown in figure 9. On PD-4905 model coach, this relay is mounted on the regulator and apparatus panel on front intermediate bulkhead as shown in figure 10. Electrical circuits and connections are shown on applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Reading lamp relay "BAT." (No. 1 terminal) is fed from battery junction on intermediate relay and apparatus panel or regulator and apparatus panel. Relay operating coil is energized from "Reading" position of the interior light switch. When operating coil circuit is completed, relay points close to complete circuit to reading lamp switches through No. 2 and No. 3 circuit breakers on intermediate relay and apparatus panel or regulator and apparatus panel.

REGULATOR SENSING RELAY
(MODEL PD-4905)

Regulator sensing relay is mounted on regulator and apparatus panel on front intermediate bulkhead (fig. 10). Electrical circuits and connections are shown on applicable "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Regulator sensing relay "BAT." terminal (No. 1) is fed from "DC" terminal on generator. Relay operating coil terminal (No. 3) is energized from

"Normal" position of engine starter switch on driver's instrument panel through engine compartment junction No. 1. When circuit to operating coil is completed, relay points close and circuit is completed from battery to "P" terminal on voltage regulator which feeds current to "Field" circuit of generator.

WATER PUMP RELAY
(MODEL PD-4108 AND PD-4905)

The water pump relay is mounted on the ventilation compartment apparatus panel (fig. 11). Electrical circuits and connections are shown on applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

On PD-4108 coach models, water pump relay "BAT." terminal (No. 1) is fed from a 35-Amp circuit breaker on intermediate relay and apparatus panel. Relay operating coil terminal (No. 3) is energized from "HEAT" position on heating and air conditioning switch on driver's control panel. When circuit to operating coil is completed, relay points close and circuit is completed from battery to water pump.

On PD-4905 coach models, water pump relay "BAT." terminal (No. 1) is fed from a 60-Amp circuit breaker on battery compartment hot bus bar. Relay operating coil terminal (No. 3) is energized from "HEAT" position on heating and air conditioning switch on driver's control panel. When circuit to operating coil is completed, relay points close and circuit is completed from battery to water pump through an 8-Amp circuit on the blower motor apparatus panel.

RELAY TEST

With all leads connected to the relay as shown on applicable wiring diagram, connect an accurate reading voltmeter parallel with relay operating coil circuit at No. 3 and No. 4 terminals. Insert a variable resistance unit in series with the operating coil. To check closing voltage, close relay operating switch, then slowly decrease resistance until points close and note voltage reading. In some instances, generator must be charging to energize the relay operating circuits.

If opening voltage is not within limits listed in "Specifications" at end of this section, replace the relay.

RELAY 1116969

GENERATOR CONTROL RELAY
MODEL PD-4108 AND PD-4905)

Generator relay is mounted on driver's control and apparatus panel at left of driver (fig. 3) on PD-4108 model coach and on regulator and apparatus panel (fig. 10) on PD-4905 model coach. Refer to applicable "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

On PD-4108 model coach, relay "BAT." (No. 1) terminal is fed from driver's control panel battery junction through the engine run relay (magnetic switch). Operating coil terminal No. 3 is connected to "R" terminal of generator. When generator is charging, current is supplied from relay "R" terminal of generator through operating coil of relay to ground through terminal No. 4. This action closes contact points to permit battery current to feed heating and air conditioning switch through No. 32 circuit breaker on driver's control and apparatus panel. This circuit is used to shut down the heating and air conditioning system when generator is not charging.

On PD-4905 model coach, relay "BAT." (No. 1) terminal is fed from battery junction on regulator and apparatus panel. Operating coil terminal No. 3 is connected to "R" terminal of generator. When generator is charging, current is supplied from relay "R" terminal of generator through operating coil of relay to ground through terminal No. 4. This action closes contact points to permit battery current to feed coil winding of heat and air conditioning relay, mounted on driver's control and apparatus panel, through regulator and apparatus panel No. 6 circuit breaker. This circuit is used to shut down the heating and air conditioning system when generator is not charging.

RELAY TEST

With all leads connected to the relay as shown on applicable wiring diagram, connect an accurate reading voltmeter in parallel with the relay operating circuit at No. 3 and No. 4 terminals. Insert a variable resistance unit in series with the operating coil circuit. To check closing voltage, close the relay operating switch, then slowly decrease resistance until points close and note the voltage reading.

NOTE: The generator must be charging to energize the relay operating coil circuit.

If opening voltage is not within limits listed in "Specifications" at end of this section, replace the relay.

RESISTORS

Resistors are used in the engine and transmission low oil pressure switch circuits and in the heating system grad-u-stat circuit. The purpose of these resistors is to limit current flow within the circuit to a specified value. These resistors can be checked by connecting an ohmmeter to each end of the unit and noting the reading. If reading is not within limits listed in "Specifications" at end of this section, replace the unit.

HORNS

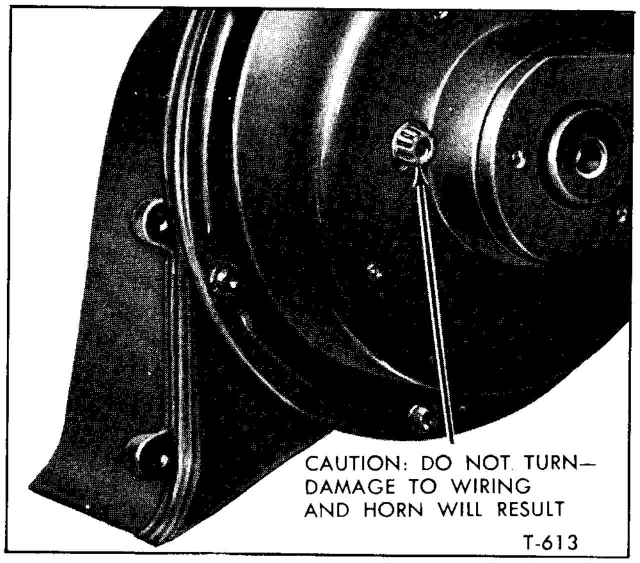


Figure 12—Electric Horn (Typical)

Two 24-volt electric air tone "S" type horns (fig. 12) and one air operated horn are located beneath right front corner of coach under step.

ELECTRIC HORNS

Each horn is carefully adjusted and inspected during manufacture and should operate indefinitely without attention. The horns are assembled with rivets and should not be adjusted or repaired. If a horn becomes inoperative, it must be replaced.

If horns become inoperative, use a jumper lead as follows to check the external circuit:

1. Connect jumper lead from No. 3 terminal on horn relay to ground. If horn then operates, the trouble is in the horn control circuit. If horn does not operate remove jumper lead and proceed with Step 2.
2. Momentarily connect jumper lead between Nos. 1 and 2 terminals on horn relay. If horn operates, the relay is defective and must be replaced.
3. Horn circuit is internally grounded through the horn mounting. Therefore, it is necessary that a good ground connection be maintained between the horn mounting bracket and its mating part. Check for a good ground by connecting a jumper lead from the horn bracket to the vehicle frame or grounded side of battery. Be sure contact is made through the paint of the horn bracket and frame.

After the above checks have been made and it is established that the horn is at fault, the trouble may be that the horn contacts are held open by a foreign particle. This condition can sometimes be corrected by energizing the horn, then lightly tapping the horn power plant to dislodge the particle.

AIR HORNS

Dual air horns are mounted on brackets located in horn compartment. Air pressure to horns is controlled by a floor mounted control valve.

NOTE: For information pertaining to air horns and control valve, refer to "Air Horns" in "GENERAL BODY MAINTENANCE" (SEC. 3).

ELECTRIC SPEEDOMETER

GENERAL

A permanent magnet AC generator (sending unit) is mounted on the speedometer adapter at rear of transmission and is driven by the transmission output shaft. The generator supplies a signal whose amplitude is proportional to its driven speed. This signal is rectified to direct current (D.C.) smoothed and fed to meter movement of the speedometer, mounted on the gauge, switch, and tell-tale panel, where it is read in miles-per-hour. A set of non-replaceable breaker points, within the generator, operate a stepping motor that drives the odometer worm gear mechanism at regular mileage intervals.

Refer to applicable "Speedometer Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

The following procedure for disassembly, testing, and calibration of speedometer system are made after units have been removed from the vehicle. Remove speedometer from gauge, switch, and tell-tale panel by disconnecting wiring from the unit, then remove nuts and washers which attach speedometer to instrument panel mounting bracket. Disconnect wiring from terminals on sending unit, then remove sending unit from the speedometer adapter.

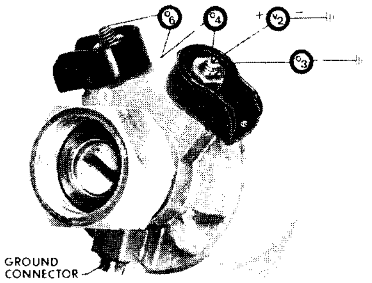
TOOLS AND EQUIPMENT

Electrical equipment and small hand tools required for diagnosing abnormal speedometer operation are listed below. Defective speedometers or generators (sending unit) are serviced by replacement.

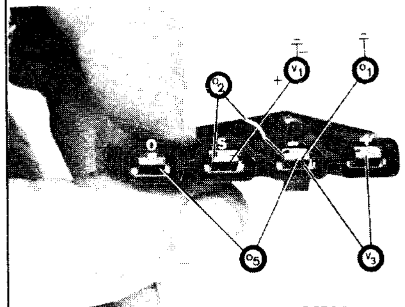
NOTE: Refer to "Trouble Analysis Chart" (fig. 13) to assist in determining which unit is defective.

1. Simpson 160 or 260 Multimeter.
2. Small hand tools such as:
   a. No. 10 and 12 nut driver.
   b. 1-1/16-inch open-end wrench.
   c. Medium blade screwdriver.

AC Electric Speedometer Quick Check Procedure



GENERATOR



PLUG IN CONNECTOR

Inoperative System

Disconnect plug-in connector at rear of speedometer.

Connect ohmmeter between "-" terminal of connector and ground (Test 0_1).

If infinity is shown, repair open ground circuit.
If continuity is shown, proceed to next step.

Connect voltmeter to "S" terminal of connector and ground (Test V_1) switch voltmeter to AC scale. Operate vehicle at an estimated 10 m.p.h.

If a steady voltage indication of approximately 1-1/2 volts is indicated, replace defective speedometer.

If no voltage is indicated, proceed to next step.

Disconnect wire at "S" terminal of generator. Connect voltmeter to this terminal. Lift rear wheels (Test V_2) and operate vehicle at an estimated 10 m.p.h.

If no voltage is shown, generator drive key may be broken or disengaged. Make visual check; replace if required and repeat Test V_2.

If no voltage is indicated, replace generator.

If a voltage indication of approximately 1-1/2 volts is shown, repair or replace defective lead-in wire.

Inoperative Speedometer (Odometer Functional)

Disconnect plug-in connector at rear of speedometer.

Connect ohmmeter between "S" and "-" connectors. (Test 0_2).

If an indication of 45 ± 5 ohms is shown, replace defective speedometer.

If an open or short is indicated, go to next step.

Disconnect wire at "S" terminal of generator. Connect ohmmeter between generator "S" terminal and ground (Test 0_3).

An indication of 45 ± 5 ohms indicates that the generator is OK. Therefore, repair or replace defective lead-in wire.

If an open or short is indicated, connect ohmmeter between generator "S" terminal and generator casting (Test 0_4).

If an open or short is indicated, replace generator.

Inoperative Odometer (Speedometer Functional)

Disconnect plug-in connector at rear of speedometer. Switch voltmeter to DC scale and connect it between "+" and "-" terminals on connector. (Test V_3). If zero, repair open battery circuit; if between 10 and 16 volts, proceed with next step.

Connect ohmmeter between "0" and "-" connector at rear of speedometer. Operate vehicle a minimum of 100 ft. or lift rear wheels and operate for this distance. (Test 0_5).

When the odometer contacts within the generator are closed, the indicated resistance should not exceed 20 ohms. When the contacts are open, infinity shall be indicated. The contacts will go through one cycle in 100 ft., and while in the "closed point" condition. will not behave erratically resistance-wise.

If Test 0_5 does not meet requirements, disconnect wire at "0" terminal of generator. Connect ohmmeter between "0" terminal of generator and generator casting, and repeat outlined procedure in Test 0_5. (Test 0_6).

If Test 0_5 requirements are not satisfied, replace generator.

If Test 0_5 requirements are satisfied, repair or replace defective lead-in wire.

If Test 0_5 meets requirements, replace defective speedometer.

T-6814

Figure 13—Speedometer Trouble Analysis Chart

WIRING AND MISCELLANEOUS ELECTRICAL SPECIFICATIONS

CIRCUIT BREAKERS

NOTE: Replace Circuit Breakers With Same Make and Amperage Rating.

Type	Automatic Reset
Amperage Rating	Refer to Figures 5, 6, 7, and 8

ALARM BUZZER

(Engine, Low Air and Lavatory)

Make	Delco-Remy
Model	1115818
Point Opening	0.015-0.020
Adjust to Buzz At	0.22-0.31 Ampere at 26-28 Volt

ELECTRIC HORNS

Make	Delco-Remy
Voltage	24
Model	
Low Note	9000535
Frequency	360 C.P.S.
High Note	9000536
Frequency	450 C.P.S.

SPEEDOMETER HEAD

Make	A.C. Spark Plug Division
Model	6491726

SPEEDOMETER SENDING UNIT

Make	A.C. Spark Plug Division
Model	6469711

SPEEDOMETER ADAPTER

Make	A.C. Spark Plug Division
Model	
PD-4108	1565177
PD-4905	1565176

RELAYS

NOTE: Refer to "Relay Tabulation" Previously in This Section for Relay Application on Each Coach Model.

001481 (Magnetic Switch)

Make	Delco-Remy
Type	Magnetic Switch
Rated Voltage	24
Current Consumption	
Both Windings	
Amps	0.83-0.89
Volts	24

572758

Make	
Model	
Rated Voltage	

656841 (Time Delay)

Make	Hoagland Instrument
Model	H-102-27C20
Rated Voltage	27
Time Delay	20 ± 3 Sec.

658311

Make	Metals and Controls
Model	2CR-42-124
Rated Voltage	24

672758

Make	Prestolite Controls Co.
Model	12A-248
Rated Voltage	24

RELAYS (CONT.)

1115860

Make	Delco-Remy
Point Opening (In.)	0.020-0.030
Sealing Voltage	14-18

1115861

Make	Delco-Remy
Air Gap at Core Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.030
Closing Voltage (Range)	15.5-18.5
Closing Voltage (Range)	15.5-18.5
Opening Voltage	1.5 Min.
Sealing Voltage	22.5 Min.

1115871

Make	Delco-Remy
Voltage	12

1116964

Make	Delco-Remy
Air Gap at Core Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.030
Closing Voltage (Range)	15.5-18.5
Opening Voltage	1.5 Min.
Sealing Voltage	22.5 Max.

1116969

Make	Delco-Remy
Air Gap at Core Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.025
Closing Voltage (Range)	8.8-10.2
Opening Voltage	0.6 Min.
Sealing Voltage	11.2 Max.

RESISTORS

Engine and Transmission Low Oil	30 OHM
Gradustat	4.3 OHM ± 5%

Batteries

IMPORTANT: ELECTRICAL SYSTEM IS NEGATIVE GROUND.

Service information applicable to batteries used on coaches covered by this supplement remains the same as covered under "BATTERIES" pages 160 through 164 in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814, except as follows:

GENERAL

On PD-4108 model coach, two 12-volt batteries, connected in series, are mounted in the battery compartment located behind left rear wheelhouse at rear of coach (fig. 1).

On PD-4905 model coach, two 12-volt batteries, connected in series, are mounted in the right front evaporator compartment.

BATTERY DISCONNECT SWITCH

A battery disconnect switch is mounted in top of each battery compartment (figs. 2 or 3).

If it is necessary to disconnect batteries from the electrical system, move disconnect switch lever at top of battery compartment to "OFF" position, then disconnect battery negative (-) cables at points shown in figure 1 or 2.

IMPORTANT: After battery cables have been disconnected wrap terminals with electrical tape.

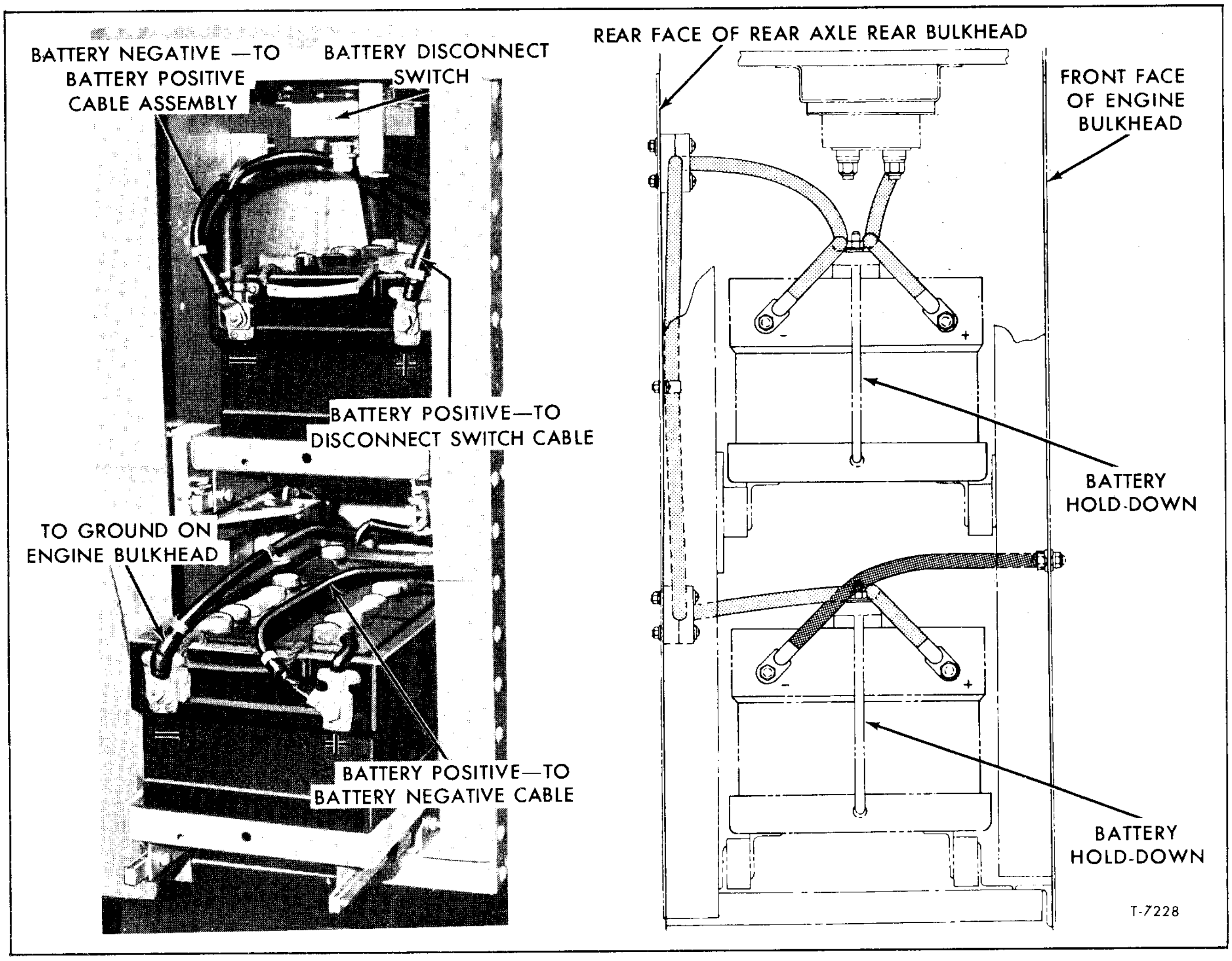

BATTERY NEGATIVE —TO BATTERY POSITIVE CABLE ASSEMBLY
BATTERY DISCONNECT SWITCH
BATTERY POSITIVE—TO DISCONNECT SWITCH CABLE
TO GROUND ON ENGINE BULKHEAD
BATTERY POSITIVE—TO BATTERY NEGATIVE CABLE
REAR FACE OF REAR AXLE REAR BULKHEAD
FRONT FACE OF ENGINE BULKHEAD
-
+
BATTERY HOLD-DOWN
-
+
BATTERY HOLD-DOWN
T-7228

Figure 1—Batteries Installed (Model PD4108) (Typical)

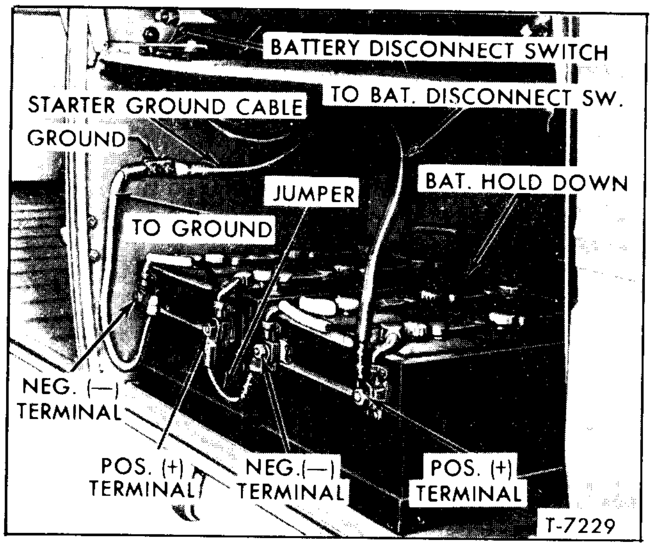


Figure 2—Batteries Installed (Model PD4905)

BATTERY TESTS

In addition to battery tests described in "BATTERIES" (SEC. 7) in Maintenance Manual X-6814, a light load test may be performed as follows:

BATTERY LIGHT LOAD TEST

NOTE: A number of suppliers have approved testing equipment available, such as tester (J-22552).

These testers have a programmed test procedure consisting of a series of timed discharge and charge cycles, requiring approximately 2 to 3 minutes, that will determine the condition of the battery with a high degree of accuracy. When using these testers, follow procedures recommended by the tester manufacturer. The battery should not be charged prior to testing as doing so may alter the test results.

BATTERY LIGHT-LOAD TEST

Check electrical condition of battery cells as follows:

1. If electrolyte level in each cell is low, adjust to proper level by adding water.
2. Place load on battery by cranking engine. If engine starts, turn off ignition immediately. If engine does not start, hold starter switch "ON" for 3 seconds, then release.
3. Turn on headlights (low beam). After one minute, with lights still "ON" read voltage of each cell with voltmeter, compare readings with the following:

Good Battery

1. If all cells read 1.95 volts or more and the difference between the highest and lowest cell is less than .05 volt, battery is good.
2. If cells read both above and below 1.95 volts and the difference between the highest and lowest cell is less than .05 volt, battery is good but requires charging. See "Charging After Light Load Test."

Replace Battery

If any cell reads 1.95 volts or more and there is a difference of .05 volt or more between the highest and lowest cell, replace the battery.

Discharged Battery

If all cells read less than 1.95 volts, battery is too low to test properly. FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT INDICATE A DEFECTIVE BATTERY. Boost charge battery and repeat "Light Load Test." If battery is found to be good after boosting, it should be fully recharged for good performance. If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not respond after second boost charge should be replaced.

NOTE: If any battery found to be good by the "Light Load Test" does not perform satisfactorily in subsequent service, it should again be tested by the "Light Load Test" and if it still tests "good" it should be removed from vehicle and tested as outlined under "Charging" later in this section.

CHARGING AFTER THE LIGHT LOAD TEST

For best performance, a good battery should be fully charged before being returned to service.

If batteries are to be fully charged by means of a quick charger, the charge rate must be "tapered" (reduced to a safe limit) when the electrolyte temperature reaches 125°F., or when gassing becomes excessive. Failure to do so may harm the battery.

BATTERY SPECIFICATIONS

STANDARD

Make	Delco-Remy
Model No.	8DR-205
Catalog No.	760
Quantity	2, Connected in Series
Volts	12
No. of Plates Per Cell	27
Amp. Hr. Capacity at 20 Hr. Rate	205
Cranking Ability at 0°F	10.5 Min. at 300 Amps

OPTIONAL

Make	Delco-Remy
Model	DC-250
Catalog No.	984
Quantity	2, Connected in Series
Volts	12
No. of Plates Per Cell	29
Amp. Hr. Capacity at 20 Hr. Rate	205
Cranking Ability at 0°F	10.5 Min. at 300 Amps

OPTIONAL

Make	The Electric Storage Battery Co.
Quantity	2, Connected in Series
Type	HY-CAP 8D-1145H
No. of Plates Per Cell	25
Amp. Hr. Capacity at 20 Hr. Rate	200

Starting System

INFORMATION CONTAINED IN THIS SECTION IS COMPLETE AND NOT SUPPLEMENTARY.

GENERAL

The starting system includes the batteries, starter, starter solenoid, starter control relay or magnetic switch, starter switches, circuit breakers, and interconnecting wiring and cables. Starting system control circuits are shown on applicable "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

NOTE: For information relative to the Starter Control Relay or Magnetic Switch, refer to "Relays" in "WIRING AND MISCELLANEOUS ELECTRICAL" (SEC. 7) of this supplement.

CONTROL SYSTEM OPERATION

IMPORTANT: The starter should not be engaged longer than 15 seconds continuously. If engine does not start within this time, wait 10 to 15 seconds before second attempt.

Starter control system is inoperative with the "ENGINE CONTROL" and "ENGINE START" switches located on engine compartment control panel (fig. 1) in the "OFF" position. These switches must be in "NORMAL" position to operate starter from driver's compartment. The "ENGINE CONTROL" switch located on engine compartment control panel must be in "NORMAL" position to operate starter from engine compartment. Operation of starter is as follows:

STARTER OPERATION

IMPORTANT: The transmission shift lever must be in "NEUTRAL" position and the parking brake should be applied before operating the starter.

Starter control system is operative when "ENGINE" switch on driver's control panel is placed in "RUN" position. Before starter motor can be energized with the "START" switch, the rear start and engine control switches on engine compartment control panel must be in "NORMAL" position.

When starter switch is closed, circuit is completed through starter magnetic switch, energizing

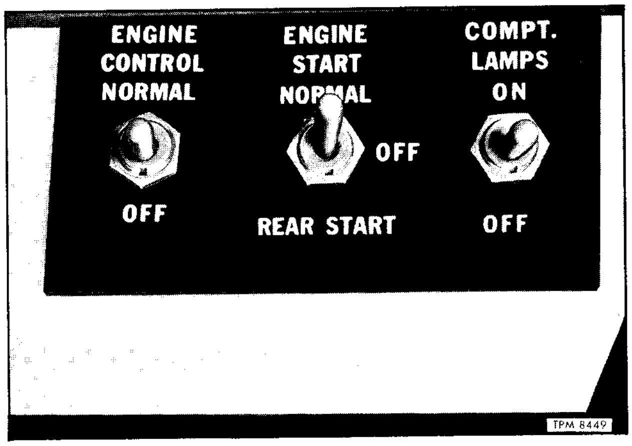


Figure 1—Engine Compartment Control Panel

starter solenoid coil. With solenoid operating coil energized, circuit is completed from battery to starter.

On coaches equipped with an automatic engine shut-off system, circuit from "ENGINE" or "ENGINE CONTROL" switch to engine stop solenoid valve is routed through normally closed contacts of engine stop relay. If engine fails to start within 20 seconds after circuit is energized, relay contacts will open; "ENGINE" or "ENGINE CONTROL" switch must then be momentarily returned to "OFF" position to close relay contacts.

CAUTION: When performing maintenance in engine compartment, place "REAR START" or "ENGINE CONTROL" switch in "OFF" position to prevent engine from being started from driver's control panel. When starting engine from rear controls, make sure transmission is in "NEUTRAL" position and hand brake is applied.

STARTER

DESCRIPTION

Starter (fig. 2) is a heavy duty unit, solenoid operated through an enclosed shift lever. The starter is equipped with a heavy duty "DR-250" type overrunning clutch. A removable plug is provided in shift lever housing to permit adjustment of pinion clearance.

Armature shaft is supported in bronze bushings at three points -- in commutator end frame, in shift lever housing, and in nose housing. Positive lubrication is provided at each bushing by an oil saturated wick that projects through the bushing and contacts the armature shaft. A waste-filled oil reservoir for each wick provides a large oil supply.

O-ring seals are used between commutator end frame and field frame, and between shift lever housing and field frame. A spring-loaded lip-type oil seal together with an O-ring seal in shift lever housing and a boot over the solenoid plunger prevent entry of transmission oil into the armature, field coils, and solenoid case.

Two brushes are carried in each of four holders mounted on plates which are attached to, but insulated from, the commutator end frame. As shown on wiring diagram (fig. 3), two sets of brushes connect to the ground terminal stud on commutator end frame; these connections are made through the brush holder mounting plate. The other two sets of brushes, which are insulated from the mounting plate, connect to the field coil leads.

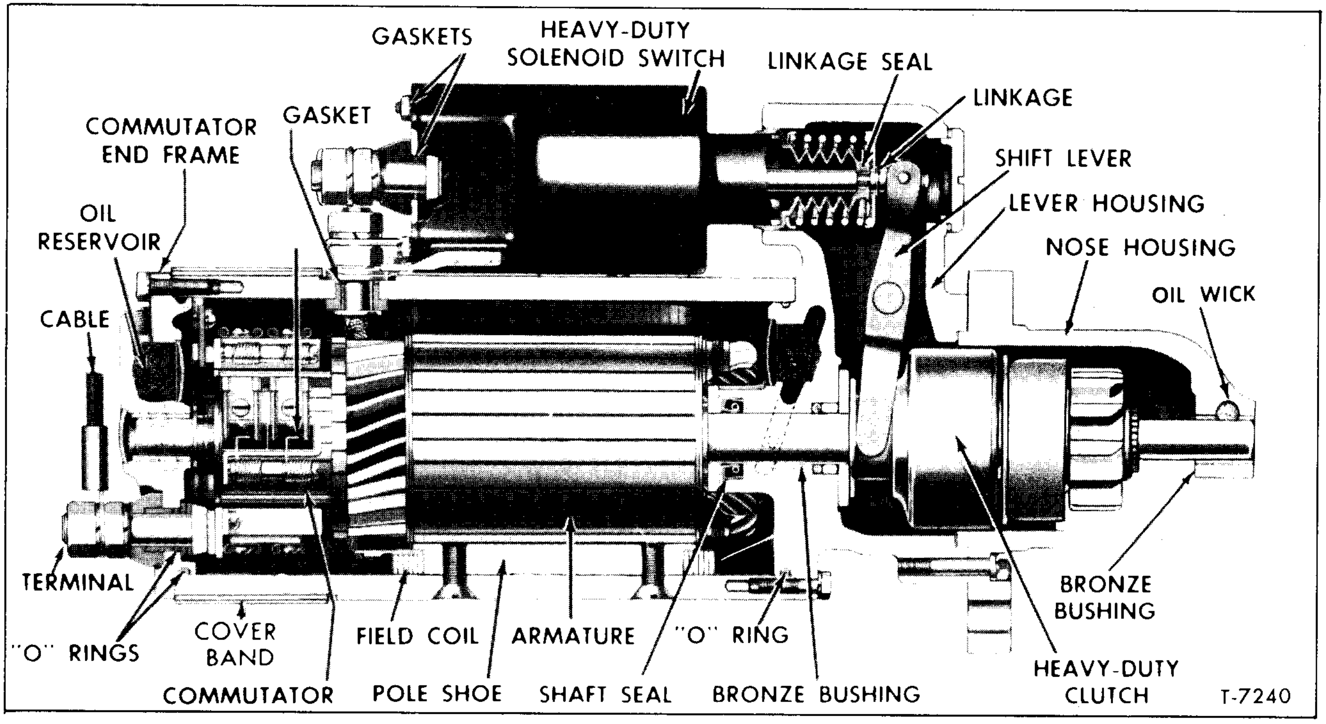


Figure 2—Starter and Solenoid Assembly (Typical)

STARTER DRIVE OPERATION

When starter circuit is energized, solenoid operated shift lever moves the pinion into mesh with the flywheel ring gear. The pinion remains engaged until starting is assured and the solenoid circuit is interrupted. In case of a butt engagement, the motor will not be energized thus preventing damage to the pinion and gear teeth. A protective sleeve on the clutch spline acts as a stop for the pinion if extreme tooth abutment occurs. This limits clutch travel, preventing switch contacts in solenoid from closing. Thus, armature cannot rotate before pinion is properly engaged, preventing damage to pinion and ring gear.

STARTER REPLACEMENT

Starter is accessible through access panel opening under rear seat.

REMOVAL

1. Remove rear seat and engine compartment access panel.
2. Disconnect exhaust pipe from manifold; then remove the manifold.
3. Disconnect negative battery cable from battery or move battery disconnect switch to "OFF" position.
4. Remove wires and cable from starter solenoid.
5. Secure a suitable strap around the starter then remove bolts which attach starter to engine. Carefully remove starter through access panel opening.

INSTALLATION

1. Using a suitable strap to support the starter, carefully lower starter motor into position on engine through access panel opening. Install three bolts to attach starter to engine and tighten securely.
2. Connect cable and wires to terminals on starter solenoid.
3. Connect exhaust pipe to manifold and attach exhaust manifold to engine.
4. Install engine access panel cover, then install rear seat.
5. Connect negative battery cable to battery (if removed) or move battery disconnect switch to "ON" position.

MAINTENANCE

All wicks and oil reservoirs should be saturated with S.A.E. 10 oil and the splines underneath the clutch should be lubricated with a light coat of S.A.E. 10 oil. Other than periodic lubrication and keeping cable connections clean and tight, the starter should require no periodic maintenance. The brushes can be inspected and replaced without disassembling the starting motor; however, it must be removed from the engine.

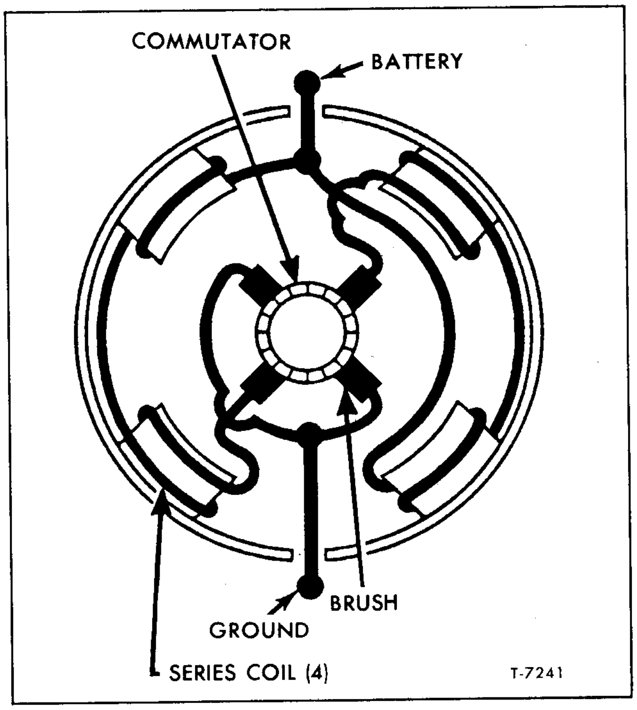


Figure 3—Starter Internal Wiring Diagram

BRUSH REMOVAL

1. Remove starting motor from engine as explained previously.
2. Remove screws attaching the two cover plates to commutator end of field frame.
3. Remove screws and washers which attach brush leads and field coil leads to brush holders.
4. Using a screwdriver as shown in figure 4, bend brush holder spring back and remove brush from holder.

BRUSH INSPECTION

1. Inspect brushes for wear. When brushes are worn down to less than one-half their original length, they must be replaced (original length is 3/4-inch).
2. Make sure brush holders are clean and brushes are not binding in the holders. The full brush surface should ride on the commutator to give proper performance.
3. Check by hand to ensure that the brush springs are giving firm contact between the brushes and commutator. If springs are distorted or discolored, they should be replaced.
4. Be sure all leads are secure in brushes and that clips are properly soldered to leads.

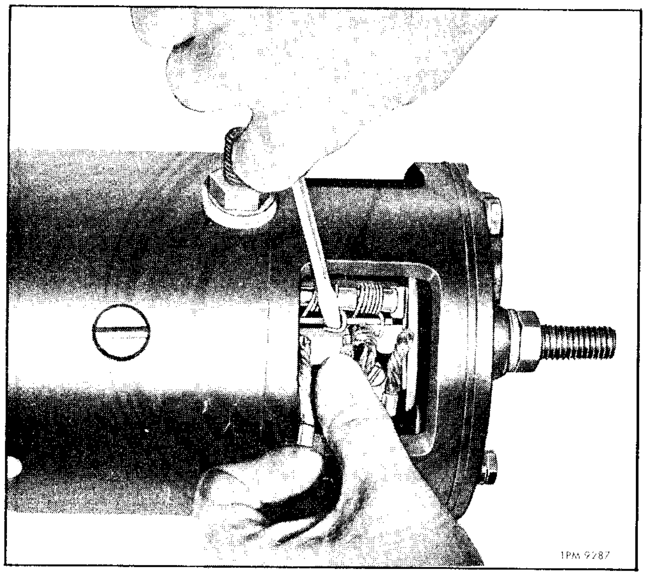


Figure 4—Removing or Installing Brushes

BRUSH INSTALLATION

1. Using screwdriver to bend brush holder spring as shown in figure 4, and with groove in brush aligned with ridge in holder, insert brushes in holders.
2. Position brush leads and field coil leads to brush holders and attach with one screw and washer in each brush. Tighten screws firmly.
3. Position cover plates over brush openings in commutator end of field frame and tighten screws firmly.
4. Install starting motor on engine as explained previously.

STARTER REPAIR

Before removing any unit in the cranking circuit for repair, the following checks should be made.

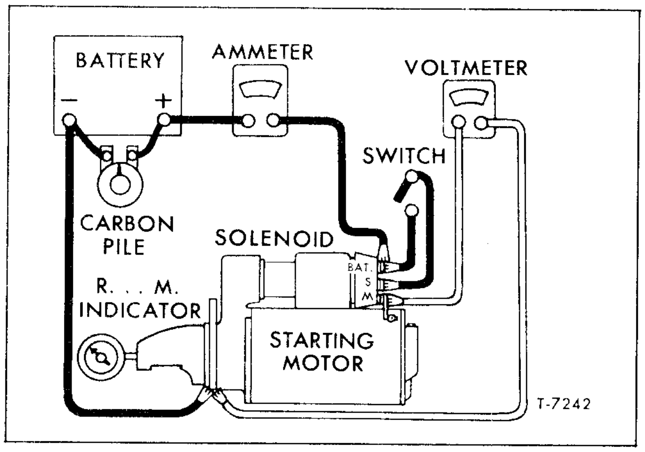


Figure 5—Starter No-Load Test Connections

BATTERY

To ensure that battery is fully charged perform battery tests as explained under "BATTERY" previously in this supplement and in Maintenance Manual X-6814.

WIRING

Inspect wiring for damage and inspect all connections for corrosion or looseness. Clean and tighten all connections as required.

MAGNETIC SWITCH, SOLENOID AND CONTROL SWITCHES

Inspect all switches to determine their condition. Connect a jumper lead around any switch suspected of being defective. If the system functions properly using this method, replace the bypassed switch.

MOTOR

If the battery, wiring, and switches are in satisfactory condition, and the engine is known to be functioning properly, remove the motor and perform starting motor tests following:

STARTING MOTOR TESTS

IMPORTANT: Never operate the starting motor more than 30 seconds at a time without pausing to allow it to cool at least two minutes. Overheating, caused by excessive cranking, will seriously damage the starting motor.

With starting motor removed from the engine, check armature for freedom of rotation by prying on the pinion with a screwdriver. Tight bearings, a bent armature shaft, or a loose pole shoe screw will cause the armature to not turn freely. If the armature does not turn freely, the motor should be disassembled. However, if the armature does rotate freely, the motor should be given a no-load test before disassembly.

STARTER NO-LOAD TEST
(Refer to Fig. 5)

Before disassembling the starter, the following check of starter operation should be made to determine conditions which may require special attention during overhaul.

To perform this test, make test connections as follows:

1. Connect an ammeter in series with the positive (+) terminal of two 12-volt batteries connected in series and the "BAT" terminal of the starter solenoid.
2. Connect a switch in the open position from the starter solenoid "BAT" terminal to the solenoid switch "S" terminal.
3. Connect a lead from the starter frame to the battery negative (-) terminal.

4. Connect a voltmeter from the solenoid motor (M) terminal to ground on the starter frame.

5. Install an rpm indicator (tachometer) to end of armature shaft to determine armature rpm.

6. Close the switch and compare the rpm, current, and voltage reading with specifications listed at end of this section. It is not necessary to obtain the exact voltage specified as an accurate interpretation can be made by recognizing that if voltage is slightly higher the rpm will be proportionately higher with the current remaining essentially unchanged.

If an exact voltage reading is desired, connect a carbon pile across one of the two 12-volt batteries to reduce voltage to a specified value.

No-Load Test Results

1. Rated current draw and no-load speed indicates normal condition of the starting motor.

2. Low free-speed and high current draw indicates:

a. Excessive friction-tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

b. Shorted armature. This can be further checked on a growler after disassembly.

c. Grounded armature or fields. Check further after disassembly.

3. Failure of starter to operate with high current draw indicates:

a. A direct ground in the terminal or fields.

b. "Frozen" bearings. This should have been determined by turning the armature by hand.

4. Failure to operate with no current draw indicates:

a. Open field circuit. This can be checked after disassembly by inspecting internal connections and tracing circuit with a test lamp.

b. Open armature coils. Inspect the commutator for badly burned bars after disassembly.

c. Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

5. Low no-load speed and low current draw indicates high internal resistance due to poor connections, defective leads, dirty commutator and causes listed under Step 4 previously.

6. High free-speed and high current draw indicates shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

STARTER DISASSEMBLY

(Refer to Figure 2)

Normally the starting motor should be disassembled only so far as is necessary to make repair or replacement of defective parts. As a precaution, safety glasses should be worn when disassembling or assembling the starting motor.

1. Using a prick punch or small chisel, mark relative positions of commutator end frame and shift lever housing to field frame, and position of nose housing to shift lever housing so they can be reassembled in same positions.

2. Remove nut and lock washer attaching solenoid "Motor" terminal connector strap to terminal stud on field frame. Also, disconnect solenoid ground lead from terminal stud on commutator end frame.

3. Remove brush inspection plates from commutator and field frame assembly, then remove the brush lead screws. This will disconnect the field coil leads from the brush holder.

4. Remove bolts and lock washers which attach commutator end frame to field frame. Remove commutator end frame assembly from field frame and armature shaft. Remove thrust washer from armature shaft.

5. Remove plug and gasket from shift lever housing. Remove nut from end of solenoid plunger rod, then remove four cap screws and washers which attach solenoid assembly to field frame.

6. Remove six socket-head screws which attach nose housing to shift lever housing. Remove nose housing from lever housing and armature shaft.

7. Remove bolts and lock washers which attach shift lever housing to field frame. Separate field frame from shift lever housing and remove.

8. Withdraw armature from shift lever housing, removing drive clutch assembly from armature shaft as armature is removed. Remove brake washer from armature shaft, and remove collar and O-ring from counterbore in shift lever housing.

9. It is not necessary to further disassemble starter unless parts require replacement as directed later under "Inspection, Tests, and Repair."

INSPECTION, TESTS, AND REPAIR

(Refer to Figure 2)

The overrunning clutch assembly, armature, and field frame and coil assembly should not be cleaned in a degreasing tank or with grease dissolving solvents, since these would dissolve the lubricant in the clutch mechanism and damage the insulation in the armature and field coils. All parts except the clutch should be cleaned with oleum spirits and a brush. The clutch should be wiped with a clean cloth.

If the commutator is dirty, it may be cleaned with No. 00 sandpaper. NEVER USE EMERY CLOTH TO CLEAN THE COMMUTATOR.

ARMATURE

If the armature commutator is worn, dirty,

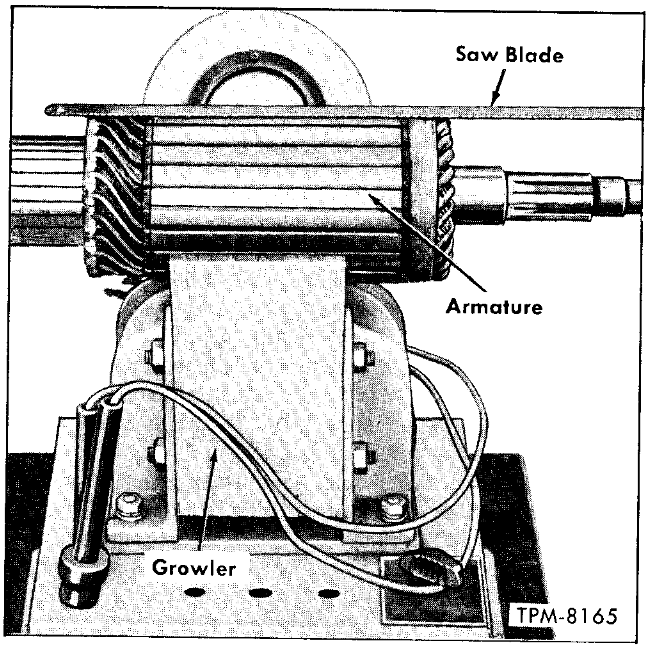


Figure 6—Checking Armature for Shorts

out-of-round, or has high insultion, the armature should be placed in a lathe and the commutator turned down. Do not cut deeper than necessary to remove rough spots or out-of-round condition. The insulation should then be undercut 1/32 of an inch wide and 1/32 of an inch deep, and the slots cleaned out to remove any trace of dirt or copper dust. As a final step in this procedure, the commutator should be sanded lightly with No. 00 sandpaper to remove any burrs left as a result of the undercutting procedure.

The armature should be checked for an open circuit, short circuit, and grounds as follows:

Open Circuit Test

Open circuits are usually caused by excessively long cranking periods. The most likely place for an open circuit to occur is at the commutator riser bars. Inspect the points where the conductors are joined to the commutator bars for loose connections. Poor connections cause arcing and burning of commutator bars. If bars are not too badly burned, repairs can sometimes be made by resoldering the leads in the riser bars, using rosin flux solder. After soldering, turn down commutator and undercut the insulation.

Short Circuit Test

Short circuits in the armature are located by the use of a growler. When armature is rotated in the growler with a steel strip such as a hacksaw blade held above it, the blade will vibrate above the area of the armature core in which the short circuit is located (fig. 6). Shorts between bars are sometimes produced by brush dust or copper between the bars. These shorts can be eliminated by cleaning out the slots. The probability of shorts between the bars is reduced because of insulation type and high copper content brushes.

Ground Test

Grounds in the armature can be detected with a 110-volt test lamp and test points. If the lamp lights with one test point on commutator and the other on the core or shaft, the armature is grounded. Grounds occur as a result of insulation failure, which is often brought about by overheating due to excessively long cranking periods, or by accumulation of brush dust between the commutator bars and the steel commutator ring.

FIELD COILS

Internal wiring circuits are shown in figure 3. The field coils can be checked for grounds and opens using a test lamp.

1. GROUNDS - The field coil ground connection must be disconnected during this test. Connect one lead of a 110-volt test lamp to the field frame and the other lead to the field connector terminal stud on the field frame. If the lamp lights, at least one field coil is grounded which must be repaired or replaced.

2. OPENS - Connect one test lamp lead to the terminal stud on field frame and the other, in turn, to each of the field coil leads which connect to the brush holders; lamp should light. If lamp fails to light in either case, the field coils are open.

Field Coil Replacement

Field coils can be removed from the field frame by using a pole shoe screwdriver. A pole shoe spreader should also be used to prevent distortion of the field frame. Careful installation of the field coils is necessary to prevent shorting or grounding the field coils as the pole shoes are tightened into place. Each pole shoe has a long lip on one side and short lip on the other; they should be installed with the long lip pointing in the direction of armature rotation so it becomes the trailing (not leading) edge of the pole shoe.

COMMUTATOR END FRAME

Remove all brushes. Place one test lamp lead on end frame, and the other, in turn, on each of the brush holders and on terminal stud. If lamp lights it is an indication of defective brush holder insulation or terminal insulators. Replace defective insulators under brush holder mounting plates or at terminal stud.

Check brush spring tension. If not within limits listed in "Specifications" at end of this section, replace with new springs. Examine brush holders and hinge pins for bent or damaged condition. Any condition which might prohibit free brush action must be corrected.

Examine bushing in end frame for excessive wear or out-of-round condition. Original diameter of bushing is listed in "Specifications" at end of this section. Replace bushing, if necessary, as directed following:

Bushing Replacement

1. Remove expansion plug from armature shaft bore.
2. Remove expansion plug from oil reservoir and remove pipe plug from oil wick passage. Remove packing and oil wick from reservoir.
3. Press old bushing from end frame and press new bushing into place.
4. Using a drill same size as oil wick passage, run drill through passage to cut through edge of bushing. Remove burrs from bushing caused by drilling operation.
5. Install new oil wick and fill oil reservoir with fine wool packing material. Saturate reservoir packing and oil wick with engine oil, then install new expansion plug with gasket in oil reservoir opening.
6. Install new expansion plug with gasket in armature shaft bore in end frame.

SHIFT LEVER HOUSING

Inspect oil seal and bushing in shift lever housing for evidence of damage or excessive wear. Original diameter of bushing is listed in "Specifications" at end of this section. Replace bushing, if necessary, as directed in "Bushing Replacement" under "Commutator End Frame," omitting steps 1 and 6. When installing new oil seal, lip must point inward.

If shift lever appears excessively loose on lever shaft, worn parts can be replaced by removing retaining ring from exposed small end of lever shaft, then driving shaft out of housing. When installing lever and shaft, use new O-rings in grooves in shaft.

NOSE HOUSING

Inspect bushing in nose housing for wear, referring to "Specifications" for original bushing diameter. Replace bushing, if necessary, as directed in "Bushing Replacement" under "Commutator End Frame," omitting Steps 1 and 6.

STARTER DRIVE ASSEMBLY

Drive pinion must rotate freely in overrunning direction and must not slip in cranking direction. The overrunning clutch can be serviced as follows, referring to figure 7:

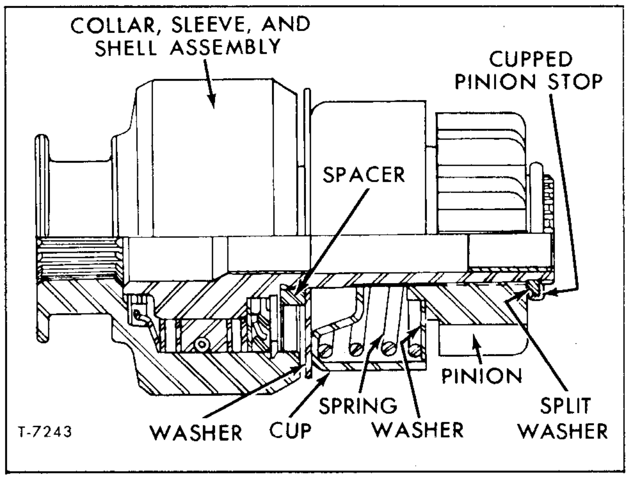


Figure 7—Drive Clutch Assembly (Type DR-250)

Disassembly

1. Using a suitable tool, remove the cupped pinion stop and the two split washers from the sleeve.

NOTE: In removing the cupped pinion stop, it will probably be damaged. Install a new cup at assembly.

2. Remove pinion, washer, spring, spring retainer cup, washer, and spacer from sleeve. Replace spring if necessary.

Assembly

1. Install spacer, washer, spring retainer cup, spring, and washer on sleeve.
2. Install pinion and a new pinion stop cup on clutch sleeve.
3. Install split-type washers in groove at end of clutch sleeve.
4. Position clutch sleeve assembly in a vise; then with pinion seated firmly against the pinion stop cup, and using suitable tools, bend pinion stop cup lip over split washers, locking pinion stop and split washers together.

STARTER ASSEMBLY

(Refer to Figure 2)

1. Lubricate splines of armature shaft with engine oil, then insert drive end of armature shaft through shift lever housing until shaft just extends through housing. Place O-ring and collar over the armature shaft and position in counterbore in housing. Place brake washer over end of shaft.
2. Position drive clutch assembly in lever housing with lugs on lever yoke engaging groove in drive clutch shift collar, then push armature shaft through housing and drive clutch.
3. Place gasket in counterbore in shift lever housing, then install nose housing over armature shaft and position at lever housing, with marks

STARTING SYSTEM

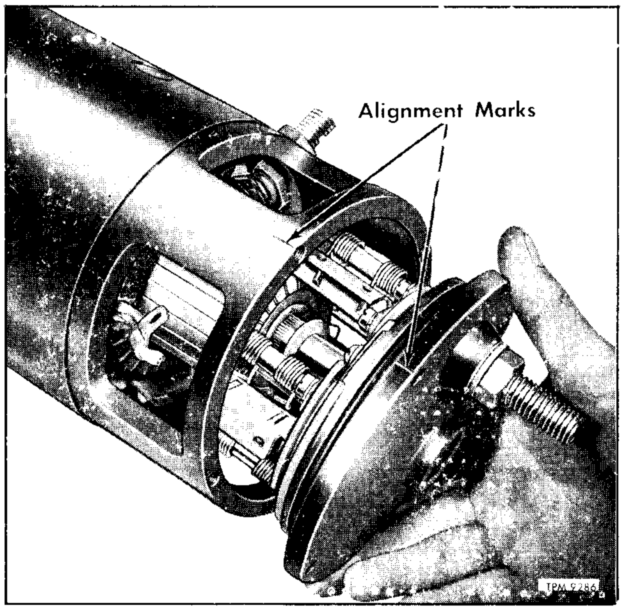


Figure 8—Installing Commutator End Frame

made prior to disassembly aligned. Attach nose housing to lever housing with six socket head screws; tighten screws to 13-17 foot-pounds torque.

4. Install new O-ring in groove in field frame side of shift lever housing. Install field frame over armature and position against shift lever housing, with marks made prior to disassembly aligned. Attach lever housing to field frame with five cap screws and lock washers. Tighten cap screws firmly.

5. Position solenoid with plunger assembly on field frame, inserting plunger rod end of solenoid into shift lever housing. Through opening in opposite side of lever housing, make sure plunger rod passes through plunger rod guide in shift lever. Thread adjusting nut a few turns onto plunger rod. Attach solenoid to field frame with four cap screws and lock washers. Install connector strap on solenoid "Motor" terminal and field frame terminal stud

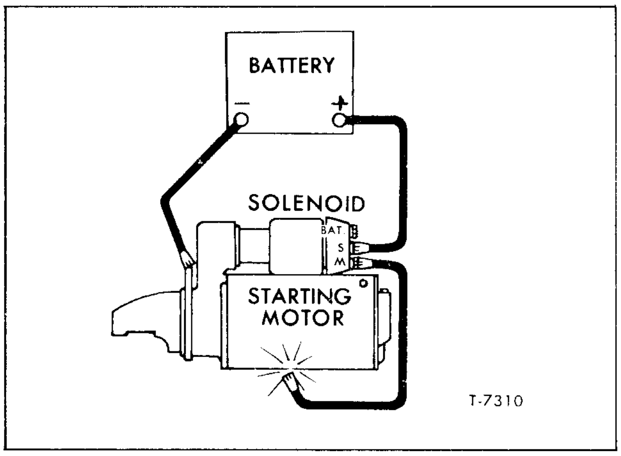


Figure 9—Test Connections for Checking Pinion Clearance

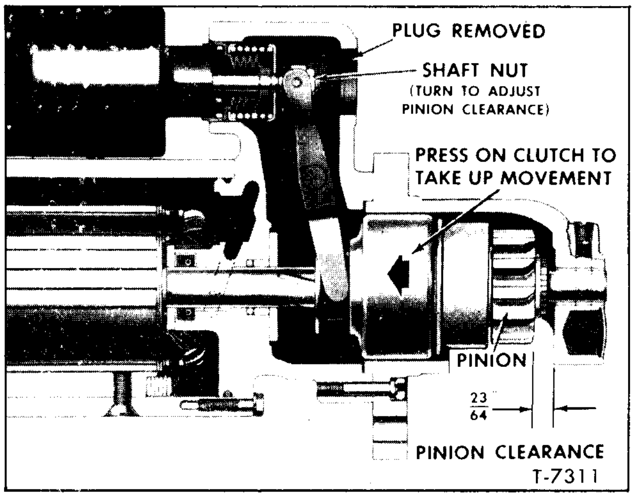

PLUG REMOVED
SHAFT NUT (TURN TO ADJUST PINION CLEARANCE)
PRESS ON CLUTCH TO TAKE UP MOVEMENT
PINION
23/64
PINION CLEARANCE
T-7311

Figure 10—Pinion Clearance Check and Adjustment

6. Place thrust washer over commutator end of armature shaft. Place new O-ring in groove around commutator end frame. Pull the armature out of the field frame just far enough to permit the brushes to be placed over the commutator. With marks made prior to disassembly aligned, push the commutator end frame and armature back against the field frame as shown in figure 8. Attach end frame to field frame with four cap screws and lock washers. Tighten cap screws firmly. Through openings in the field frame connect brush leads and field coil leads to brush holders as previously directed under "Brush Installation" under "Maintenance."

7. Install cover plates over commutator end of field frame and tighten screws firmly. Connect solenoid ground lead to terminal stud on commutator end frame.

NOTE: In order to prevent early starter failure by the entrance of water, oil, or cleaning spray, care should be taken to prevent crimping cover plates during installation.

8. Adjust pinion clearance as directed later.

9. Saturate all wicks and oil reservoirs with S.A.E. 10 oil.

PINION CLEARANCE ADJUSTMENT

1. Disconnect the motor field coil connector from the solenoid motor terminal.

2. With two 12-volt batteries connected in series, connect a test lead from the battery positive (+) terminal to the solenoid switch (S) terminal. Connect the other test lead from the battery negative (-) terminal to ground on the solenoid frame (fig. 9).

3. MOMENTARILY flash a jumper lead from the solenoid motor terminal to the solenoid frame

or ground terminal. The drive will now shift into cranking position and remain so until the battery is disconnected.

4. Push the pinion back toward the armature to take up slack, then check clearance between the pinion and nose housing (fig. 10).

5. To adjust clearance, remove plug and adjust nut on solenoid plunger rod as necessary to obtain proper clearance of 23/64-inch. After correct adjustment is obtained, install access plug and gasket in shift lever housing.

STARTER SOLENOID

Starter solenoid is used to shift the starter drive pinion into engagement with flywheel teeth and to complete the circuit from battery to starter.

Solenoid has two windings, the pull-in winding and the hold-in winding. When starter switch is closed, both windings are energized, producing a magnetic field which pulls the plunger in. Inward movement of plunger shifts starter pinion into engagement with flywheel ring gear teeth, and closes the main contacts in the solenoid switch to complete the circuit from battery to starter.

The pull-in winding draws comparatively heavy current for a short interval. This is required to shift the pinion into engagement. The hold-in winding also aids the pull-in winding. As soon as plunger closes the main switch contacts, pull-in winding is de-energized and only the hold-in winding draws current for the balance of the starting cycle.

SOLENOID MAINTENANCE

Solenoid requires no periodic maintenance other than keeping the terminals clean and tight. Always check action of solenoid if it has been removed. If unit fails to function, first check wiring before condemning the solenoid. Solenoid windings can be checked for current draw, open circuit, or shorts. Refer to "Specifications" at end of this section for current values. Solenoid coil, terminals, and switch plunger can be replaced if burned or otherwise damaged. Whenever solenoid is replaced, pinion clearance must be checked and adjusted, if necessary, as previously directed in starter assembly procedures.

STARTING SYSTEM SPECIFICATIONS

Make	Delco-Remy
Starter Model	1113953
Series	40MT
Type	250
Rotation (Viewing Drive End)	Counterclockwise
No Load Test	
Volts	20
Minimum Amps*	75
Maximum Amps*	95
Minimum RPM	5500
Maximum RPM	7500
Starter Solenoid	
Make	Delco-Remy
Model	1115517
Rated Voltage	24
Current Consumption	
Pull-In Winding	
Amps	10-11.5
Volts	5
Hold-In Winding	
Amps	6.8 Max.
Volts	20

*Includes Solenoid
(a) Pinion Clearance $\frac{23}{64}$″ Plus or Minus $\frac{1}{32}$″

BUSHING DIAMETERS (I.D.)	
Commutator End Frame	0.540″-0.544″
Shift Lever Housing	0.810″-0.813″
Nose Housing	0.625″-0.627″

Generator

A non-integral (generator and separate transistorized regulator) type generating system is used on the PD-4905 model coach and an integral (generator with solid state regulator built-in) type generating system is used on the PD-4108 model coach. In addition, a generator relay or magnetic switch is used in the generating system. A frequency sensing relay is used on the PD-4108 model coach.

Generator relay or magnetic switch and frequency sensing relay is covered under "Relays" in "WIRING AND MISCELLANEOUS ELECTRICAL" section previously.

Information pertaining to the transistorized type voltage regulator used with the non-integral type generating system remains the same as covered under "REGULATOR" pages 186 through 190 in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814.

IMPORTANT

The electrical system on these coaches is NEGATIVE GROUND. If batteries are not connected for a NEGATIVE GROUND system, severe damage to the generator, regulator, batteries, and wiring will result. Do not ground or short across any of the generator or regulator terminals.

GENERAL

The 24-volt integral or non-integral type generator used on these coaches are self-rectifying AC generators in which all current carrying members, windings, built in diodes, and field coils are stationary.

The air cooled generators are cooled by a fan on drive end of rotor shaft. An oil inlet line, connected to the drive end frame, provides circulation of engine oil through the drive end frame bearings to provide lubrication. Oil drains back into the engine crankcase through the drive end frame and gear train cover.

Power output of the integral and non-integral type generator is DC with a maximum rating of 225 amperes.

The non-integral type generator (fig. 1) has three terminals, the DC power output terminal, a field terminal, and an AC (relay) terminal. The integral type generator (fig. 2) has two terminals, the DC power output terminal and an AC (relay) terminal. The relay terminal provides voltage for the generator relay or magnetic switch. The non-integral type generating system wiring diagram is schematically illustrated in figure 3, and the integral type generating system wiring diagram is schematically illustrated in figure 4. Refer to applicable "Engine Control and Generator Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for complete electrical circuit diagram.

The generator has inherent current regulation so that an external current regulator is not required. The use of diodes eliminates the need for a

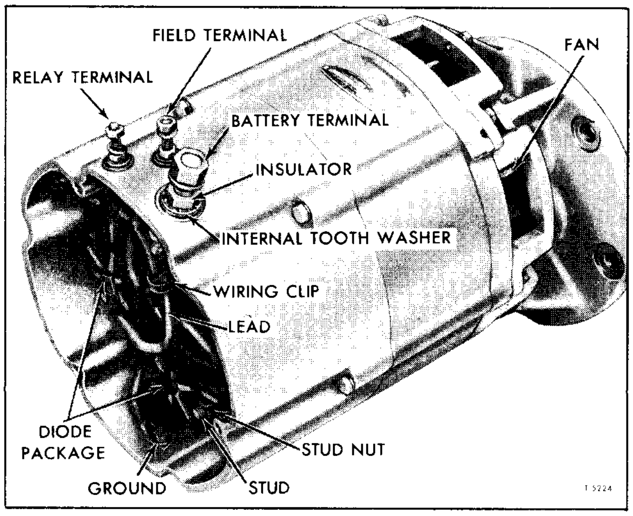


Figure 1—Generator with End Cover Removed (Model PD4905)

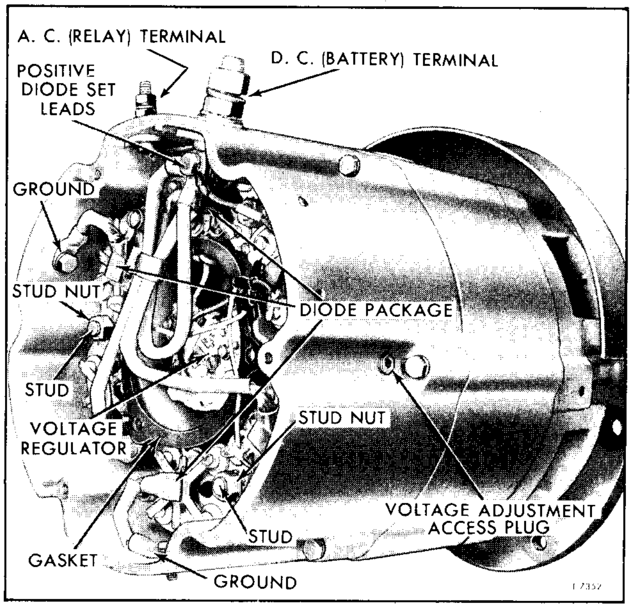


Figure 2—Generator with End Cover and Regulator Cover Removed (Model PD4108)

cut-out relay, since current cannot flow in reverse direction through the diodes.

PRECAUTIONS

Observe the following precautions when performing service operations on the generating system. Failure to observe these precautions may result in damage to the charging system.

1. Electrical system is NEGATIVE GROUND. Connecting the batteries or a battery charger with the positive terminal grounded will endanger generator diodes and vehicle wiring by high current flow. Burned wiring harnesses and burned "open" diodes will result.

2. Never operate the generator on an open circuit (field terminal connected and output terminal disconnected). With no battery or electrical load in the circuit (open circuit) the generator can build up excessively high voltage. Be sure all connections in the charging circuit are secure.

3. The generator output terminal is energized whenever the batteries are connected. If work is to be done near the generator, batteries should be disconnected to prevent accidental grounding at the generator output terminal.

4. On coaches equipped with the non-integral type generator, do not ground the generator field terminal to determine the presence or absence of field current. Grounding the generator field terminal will instantly overload and destroy transistors within the regulator.

MAINTENANCE

Since there are no brushes, slip rings, or rubbing seals, the non-integral and integral type generators require no periodic maintenance other than the following:

1. Check generator to engine mounting bolts for looseness and tighten as necessary.

2. Check all electrical connections for tightness and corrosion. Clean and tighten connection as necessary. Be sure wiring insulation is in good condition, and that all wiring is securely clipped to prevent chafing the insulation.

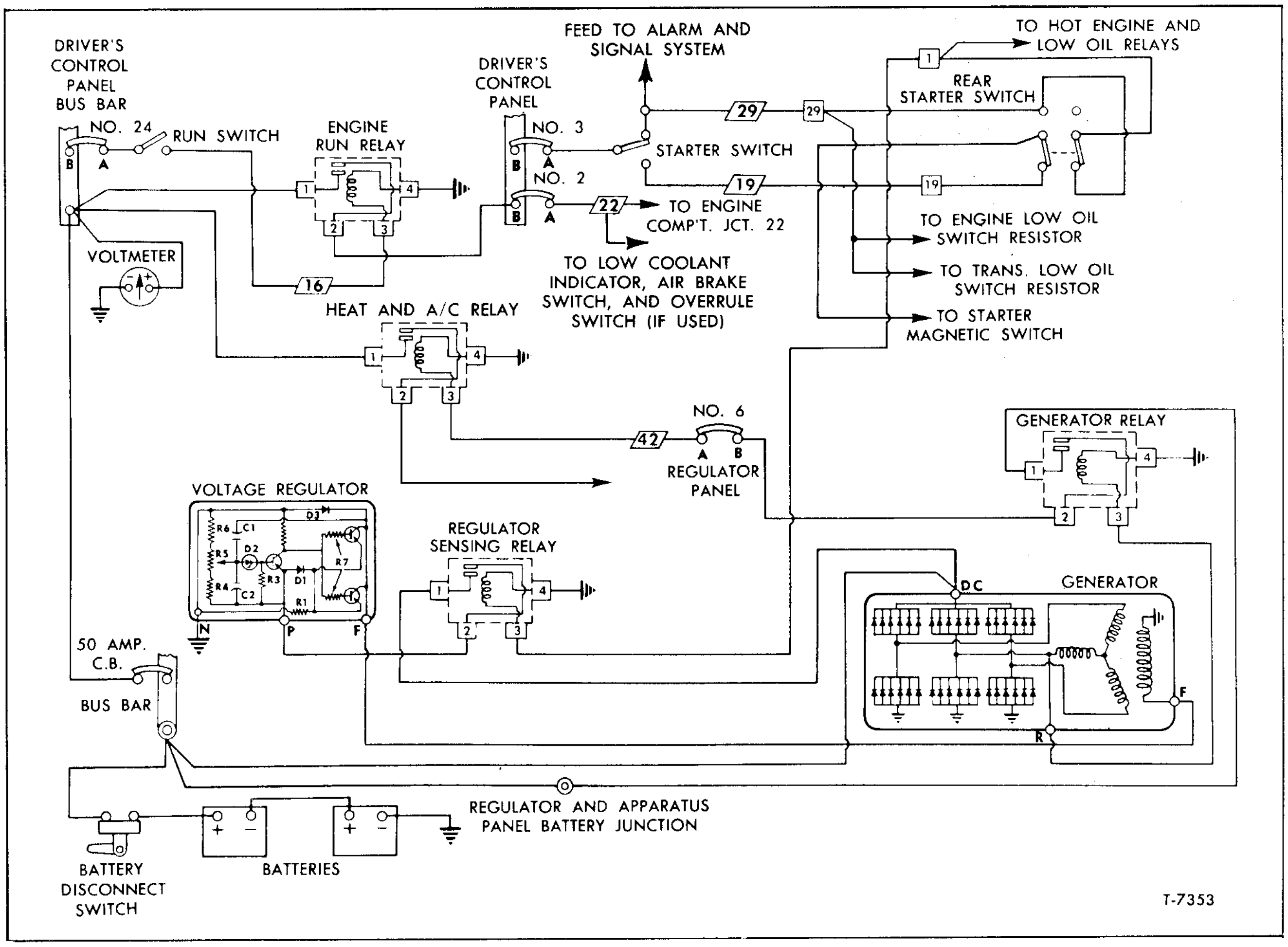

DRIVER'S CONTROL PANEL BUS BAR
NO. 24
RUN SWITCH
B
A
ENGINE RUN RELAY
1
2
3
4
FEED TO ALARM AND SIGNAL SYSTEM
DRIVER'S CONTROL PANEL
NO. 3
NO. 2
STARTER SWITCH
29
19
22
TO ENGINE COMP'T. JCT. 22
TO LOW COOLANT INDICATOR, AIR BRAKE SWITCH, AND OVERRULE SWITCH (IF USED)
TO HOT ENGINE AND LOW OIL RELAYS
REAR STARTER SWITCH
TO ENGINE LOW OIL SWITCH RESISTOR
TO TRANS. LOW OIL SWITCH RESISTOR
TO STARTER MAGNETIC SWITCH
VOLTMETER
16
HEAT AND A/C RELAY
NO. 6
42
A B
REGULATOR PANEL
GENERATOR RELAY
VOLTAGE REGULATOR
R6 C1 D3 R5 D2 R7 R3 D1 R4 C2 R1
N P F
REGULATOR SENSING RELAY
DC
GENERATOR
F
R
50 AMP. C.B.
BUS BAR
REGULATOR AND APPARATUS PANEL BATTERY JUNCTION
BATTERY DISCONNECT SWITCH
BATTERIES
T-7353

Figure 3—Generating System Schematic Wiring Diagram (Model PD4905)

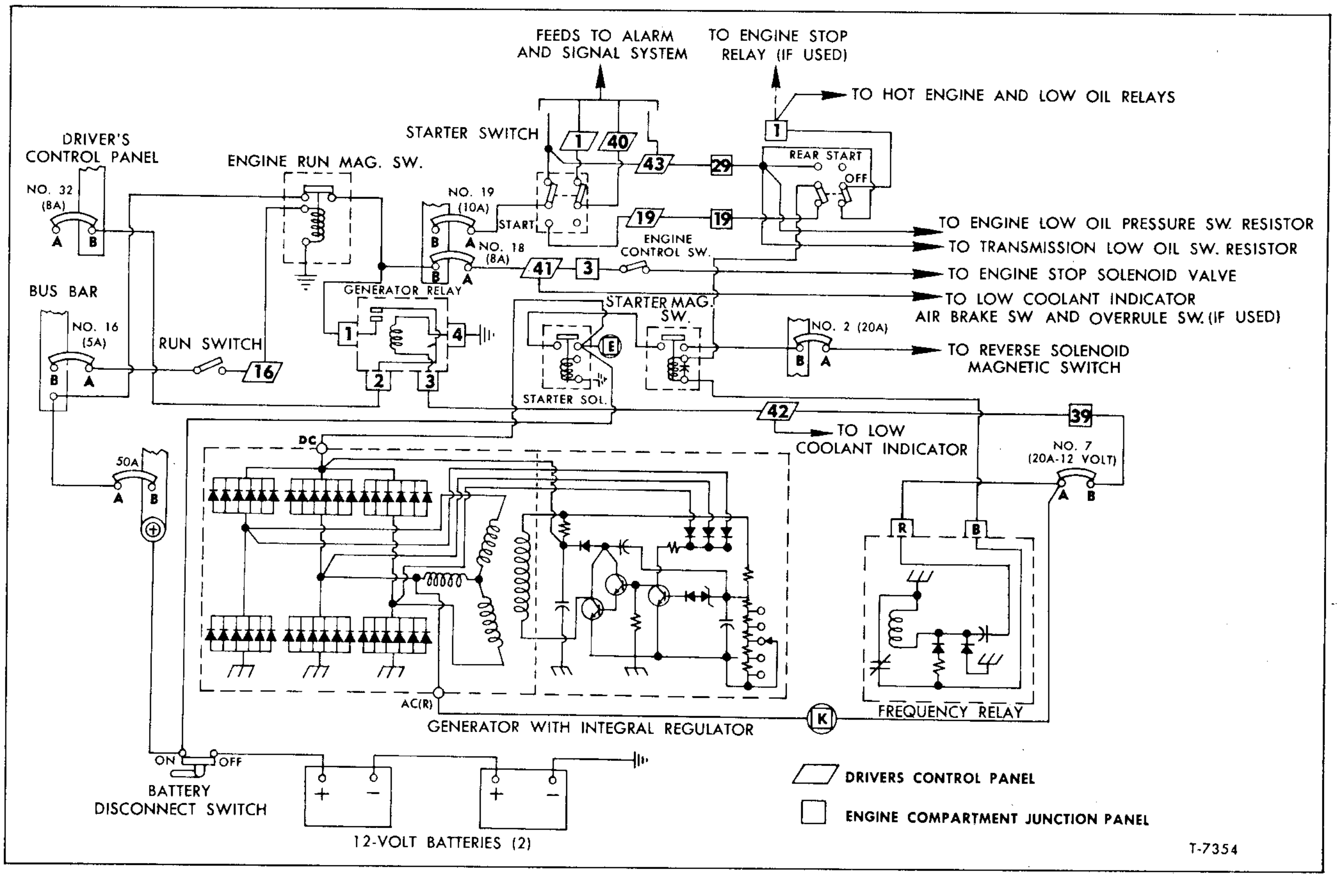

FEEDS TO ALARM AND SIGNAL SYSTEM
TO ENGINE STOP RELAY (IF USED)
TO HOT ENGINE AND LOW OIL RELAYS
DRIVER'S CONTROL PANEL
STARTER SWITCH
ENGINE RUN MAG. SW.
REAR START
OFF
NO. 32 (8A)
NO. 19 (10A)
START
ENGINE CONTROL SW.
TO ENGINE LOW OIL PRESSURE SW. RESISTOR
TO TRANSMISSION LOW OIL SW. RESISTOR
TO ENGINE STOP SOLENOID VALVE
TO LOW COOLANT INDICATOR
AIR BRAKE SW AND OVERRULE SW. (IF USED)
NO. 18 (8A)
GENERATOR RELAY
BUS BAR
NO. 16 (5A)
RUN SWITCH
STARTER MAG. SW.
STARTER SOL.
NO. 2 (20A)
TO REVERSE SOLENOID MAGNETIC SWITCH
TO LOW COOLANT INDICATOR
NO. 7 (20A-12 VOLT)
50A
DC
AC(R)
GENERATOR WITH INTEGRAL REGULATOR
FREQUENCY RELAY
ON
OFF
BATTERY DISCONNECT SWITCH
12-VOLT BATTERIES (2)
DRIVERS CONTROL PANEL
ENGINE COMPARTMENT JUNCTION PANEL
T-7354

Figure 4—Generating System Schematic Wiring Diagram (Model PD4108)

3. With engine running, listen for noise and check generator for vibration. If generator is noisy or vibrates excessively, it should be removed for inspection and repair.

4. Check battery electrolyte level and specific gravity. Replenish electrolyte level as necessary.

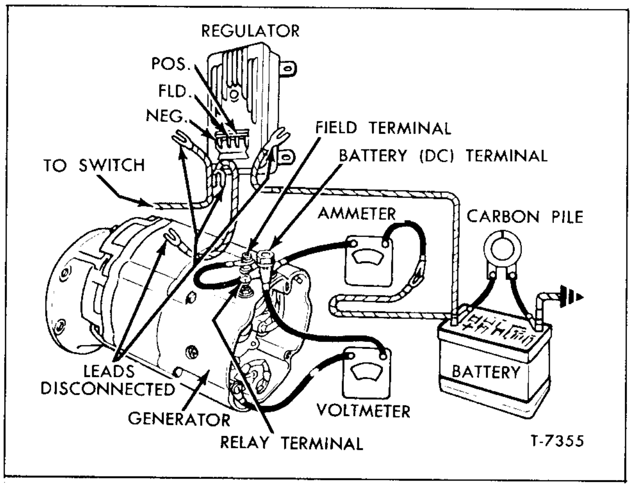


Figure 5—Checking Generator Output (Non-Integral Type Generator)

GENERATOR ON-VEHICLE CHECKS

Abnormal operation of the generating system is indicated by a voltmeter on the instrument panel in front of driver. Normally, the voltmeter will indicate a charge when the engine is started and generator is charging. If voltmeter fails to indicate a charge during operation, trouble in the generating system is indicated. The following quick checks will determine if trouble is in the generator or generator relay. Any unit which is found to be defective must be repaired or replaced.

NOTE: On vehicles equipped with the non-integral type generator, refer to "REGULATOR" pages 186 through 190 in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814 for additional checks.

Internal checks of generator components can be made as directed later under "Generator Repair."

The following is a list of the most common generator defects encountered:

1. Open or shorted generator diodes.
2. Open, shorted, or grounded stator windings.
3. Open, shorted, or grounded field windings.
4. Excessive generator noise.

GENERATOR OUTPUT CHECK (NON-INTEGRAL TYPE GENERATOR)

NOTE: Refer to figure 5 for typical test connections.

1. Disconnect negative battery cable from battery.

2. Disconnect all leads from regulator and disconnect lead from generator field terminal.

CAUTION: DO NOT allow leads to touch ground.

3. Connect an ammeter and voltmeter in circuit (shown in fig. 5) as follows:

a. Connect one ammeter lead to battery positive post and the other ammeter lead to generator "DC" terminal.

b. Connect one voltmeter lead to generator "DC" terminal and the other voltmeter lead to ground on generator frame.

4. Connect a jumper lead from generator "DC" terminal to generator "F" field terminal.

5. Connect a carbon pile load across the battery as shown.

NOTE: Make sure carbon pile is turned off.

6. Connect negative battery cable to battery.

7. Start engine and operate at approximately 1500 rpm. Turn on vehicle accessories and adjust carbon pile load until a 225 ampere current draw is shown on ammeter.

8. Check voltmeter; a minimum reading of 27 volts should be obtained.

9. If generator fails to perform within limits listed in steps 7 and 8 previously, generator is defective. Check component parts as explained under "Troubleshooting" later.

GENERATOR RELAY

Current is supplied to generator relay from relay terminal of generator. Relay contact points close when generator is charging.

1. Connect voltmeter leads to No. 3 terminal of relay and to vehicle ground.

2. Start engine and observe voltmeter reading. A reading of 12 to 13 volts is normal and indicates proper feed to relay.

3. Connect voltmeter leads to No. 1 terminal of relay and to vehicle ground. Voltmeter should read battery voltage when generator is charging. No voltage indicates a defective relay.

GENERATOR REPLACEMENT

1. Disconnect oil supply line from fitting on drive end frame. Disconnect air outlet hose from end cover.

2. Disconnect battery negative cable from battery; then disconnect battery cable from "D.C." terminal and relay "R" or "A.C." terminal. On Model PD-4905 coach, disconnect wire from field "F" terminal. Tag each wire to aid in identification at time of installation.

3. Remove nuts and washers from six mounting studs. Pull generator straight back off mounting studs to complete removal.

4. If a new or rebuilt generator is to be installed, remove driven gear for installation on replacement unit.

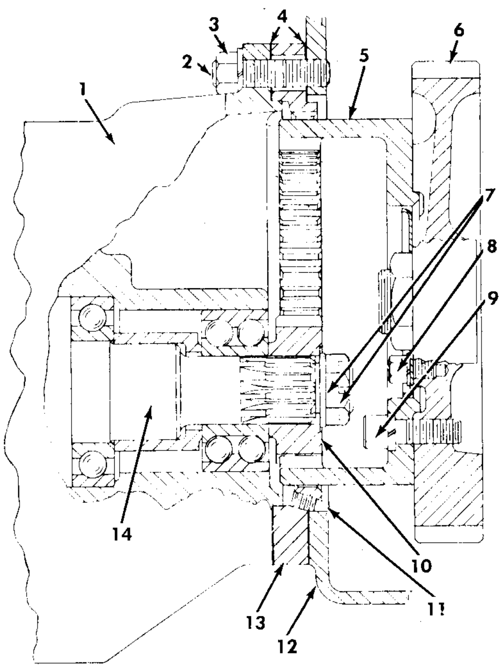
INSTALLATION

Key numbers in text refer to figure 6.

1. Before installing generator, inspect drive gear (5) for worn or damaged teeth. If wear or damage is evident, replace the drive gear as follows:

a. Remove six socket head screws (9) and washers which attach internal-toothed drive gear (5) to balance shaft gear (6). Remove drive gear.

b. Position new drive gear (5) on balance shaft gear (6) with pilot bore in balance shaft gear. Install six socket-head setscrews (9) with lock washers and tighten firmly.



1 Generator End Frame
2 Mounting Stud
3 Stud Nut
4 Gasket
5 Drive Gear
6 Balance Shaft Gear
7 Gear Retaining Nut and Washer
8 Hex-Head Screw
9 Socket Head Screw
10 Driven Gear
11 Tapered Setscrew
12 Gear Train Cover
13 Adapter
14 Rotor Shaft

T-7356

Figure 6—Generator Drive (Typical)

c. Clamp a dial indicator to drive gear (5) in such a manner that indicator pin will contact the generator end frame pilot bore in adapter (13). Turn engine over with starter while observing reading on dial indicator. Runout on pilot bore with axis of shaft should not exceed 0.002-inch total indicator reading. If necessary, adjust tapered setscrew (11) to locate adapter within limits.

2. Install driven gear (10) on generator rotor shaft and secure with flat washer and nut (7). Tighten nut to 145 to 155 foot-pounds torque.

3. Place gasket (4) over generator mounting studs. Position generator assembly on engine with holes in end frame flange over mounting studs (2) and with teeth of driven gear engaging teeth in drive gear. Install lock washers and nuts (3) on mounting studs and tighten stud nuts 55 to 65 foot-pounds torque.

4. Connect oil line to fitting on generator drive end housing.

IMPORTANT: Foreign material may clog the oil inlet orifice in drive end housing. When replacing or connecting oil lines, use care to prevent foreign material entering oil lines or fittings.

5. Connect wires to relay "R" or "A.C." terminal and connect battery cable to "D.C." terminal. On model PD-4905 coach, connect wire to field "F" terminal. Tighten terminal nuts firmly, then connect negative battery cable to battery.

6. Connect air outlet hose to end frame cover.

TROUBLESHOOTING

GENERAL

It is not necessary to completely disassemble the generator to make electrical checks. All electrical checks are made at the diode end of the generator without disassembling the rotor, drive end frame, or bearings. If electrical components are not defective, but bearing replacement is necessary, this is accomplished at the drive end without disassembling the diode end of the unit as explained under "Generator Repair."

These procedures are based on the assumption that "On-Vehicle Checks" have indicated that generator is malfunctioning and that the generator has been removed from the engine as previously directed under "Generator Replacement."

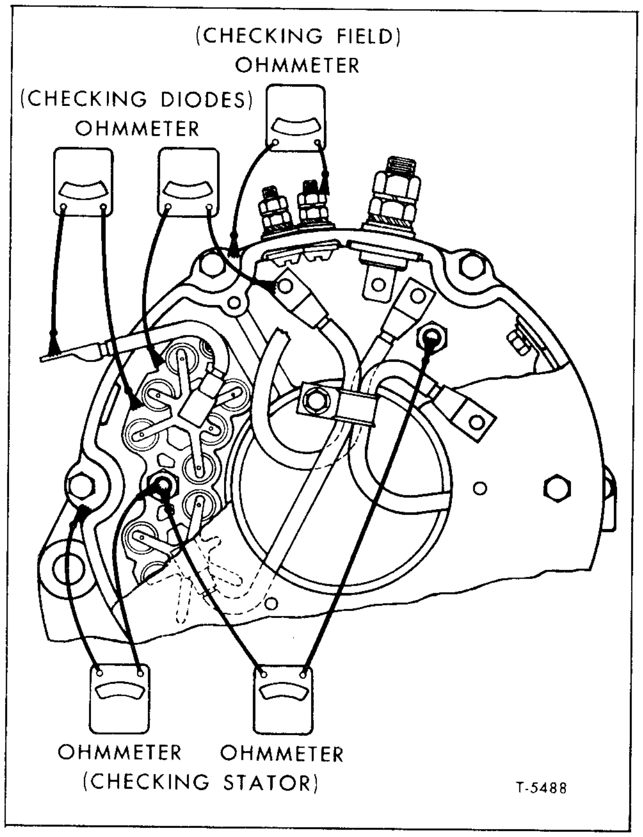


Figure 7—Ohmmeter Check (Non-Integral Type Generator)

DIODE END COVER

1. Disconnect air outlet hose from diode end frame cover.

2. Remove bolts and washers which attach end cover to diode end frame.

3. On integral type generator, remove three bolts and washers which attach regulator cover to diode end frame then remove cover being careful not to damage wiring.

DIODE CHECKS

Six sets of diodes are mounted in three heat sinks attached to the diode end frame. Each heat sink assembly consists of a set of six positive and six negative diodes. Positive diode terminal leads and negative diode terminal leads are soldered to a positive or negative diode set connector. A lead from each positive diode set is bolted to the "DC" output terminal and a lead from each negative diode set is connected to the generator frame (fig. 2).

NOTE: When checking diodes for shorts and opens, use an ohmmeter with a 1½-volt cell. Select a scale on which the 300 ohm value lies within the middle third of the scale.

IMPORTANT: DO NOT use high voltage, such as a 110-volt test lamp to check diodes.

CHECKING DIODES IN HEAT SINK
(Refer to Figure 7)

1. Disconnect three diode set leads from generator output terminal.

2. Connect one ohmmeter lead to the heat sink in which the diodes are mounted and the other ohmmeter lead to one of the diode set leads. Note the reading. Reverse ohmmeter lead connections and note the reading. The diode set is defective if both readings are less than 300 ohms, or if both readings are greater than 300 ohms. A good diode set will give one very low and one very high reading.

NOTE: If a diode set was found to be defective during the above check, replace the heat sink and diode assembly as explained under "Generator Repair" later in this section.

FIELD WINDING CHECKS

Generator field windings may be checked for opens, grounds, and shorts by checking the amperage draw of the field windings as follows:

NON-INTEGRAL TYPE GENERATOR

1. Connect an ammeter with two 12-volt batteries (connected in series) in series with generator field ("F") terminal and ground (on diode end frame).
2. The generator field should pass 5.7 to 6.2 amperes with 24 volts applied.
3. Amperage readings other than the above indicate an open, grounded, or shorted field winding.

INTEGRAL TYPE GENERATOR

1. Disconnect both field leads from the regulator, then pull end of each lead out of end frame.
2. Connect an ammeter with two 12-volt batteries (connected in series) in series with both generator field leads disconnected from the regulator and ground on the diode end frame.
3. The generator should pass 5.7 to 6.2 amperes with 24 volts applied.
4. Amperage readings other than the above indicate an open, grounded, or shorted field winding.

STATOR WINDING CHECKS

OPENS

To check stator windings for open, disconnect all six diode leads (fig. 7). Connect an ohmmeter lead to each pair of stator terminals and note the reading. The ohmmeter should show a low resistance. If an infinite or high resistance is obtained in either of the checks, the stator windings are open.

GROUNDS

To check stator windings for grounds, connect an ohmmeter to a stator terminal and the diode end frame (fig. 7). The ohmmeter should show an infinite or very high resistance. If a zero or very low resistance reading is obtained, the windings are grounded.

SHORTS

The stator windings are difficult to check for shorts without laboratory test equipment due to the very low resistance of the windings. However, if all other generator checks are satisfactory, yet the generator fails to perform according to specifications, shorted stator windings are indicated.

GENERATOR REPAIR

CLEANING AND INSPECTION

Whenever generator is disassembled, cleaning and inspection should be accomplished as follows:

CLEANING

If sludge has accumulated on the stator, a light mineral oil should be used to clean the stator.

INSPECTION

When generator has been disassembled to a point that the stator is exposed, the stator should be checked for the following:

1. Adequate varnish.

2. Proper spacing of conductors so that "near shorts" do not exist.

3. Proper phase lead placement.

4. Strong conductor and cross-over welds.

GENERATOR DISASSEMBLY

With generator removed from the engine, replace electrical components as follows:

REGULATOR REPLACEMENT
(INTEGRAL TYPE GENERATOR)

Refer to figure 8 for view of regulator installed in slip ring end frame.

Removal

1. Remove cover plate from slip ring end frame.

2. Disconnect the three diode set leads and the lead from diode mounted in the slip ring end frame housing from generator output terminal.

3. Remove bolts and washers which attach positive diode lead clip and regulator cover to slip ring end frame, then remove regulator cover.

4. Disconnect all regulator leads from regulator and diode sets. Tag each lead to aid in identification.

5. Carefully remove regulator and field leads from slots in regulator cover gasket, then remove the gasket.

6. Remove bolts and washers which attach regulator and regulator mounting block to end frame. Remove regulator and mounting block.

Installation

1. Position regulator mounting block in slip ring end frame and install two screws and washers to attach. Tighten mounting screws firmly.

2. Position regulator on mounting plate and install two screws and washers to attach to mounting plate. Tighten screws firmly.

3. Place leads in slots in regulator end cover gasket, then connect leads to regulator terminals and diode sets. Refer to identification made during regulator removal.

NOTE: Tape each lead in place as shown in figure 8. Wrap two turns around plate stem to insulate lead and 1½ turns to hold in place.

4. Position regulator cover plate on end frame,

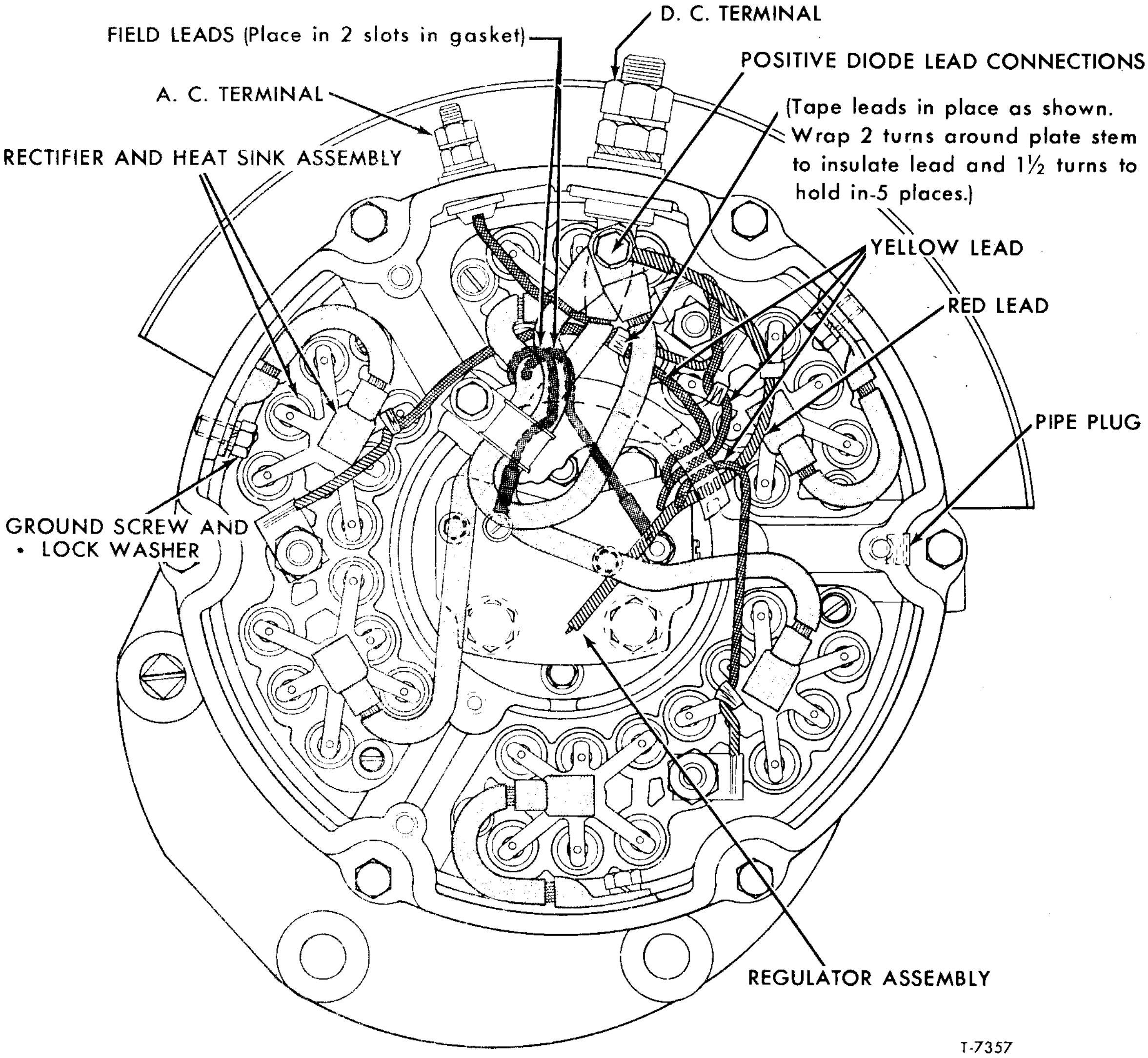

FIELD LEADS (Place in 2 slots in gasket)
A. C. TERMINAL
RECTIFIER AND HEAT SINK ASSEMBLY
D. C. TERMINAL
POSITIVE DIODE LEAD CONNECTIONS
(Tape leads in place as shown. Wrap 2 turns around plate stem to insulate lead and 1½ turns to hold in 5 places.)
YELLOW LEAD
RED LEAD
PIPE PLUG
GROUND SCREW AND • LOCK WASHER
REGULATOR ASSEMBLY
T-7357

Figure 8—Integral Type Generator Diode End Frame with End Cover and Regulator Cover Removed

then position positive diode lead clip on cover plate. Install bolts and washers to attach cover plate and diode lead clip to end frame. Tighten mounting bolts firmly.

5. Connect the three diode set leads and the lead from diode mounted in slip ring end frame housing to generator output terminal.

6. Position cover plate on slip ring end frame and attach with bolts and washers. Tighten mounting bolts firmly.

DIODE REPLACEMENT

NOTE: Replace the diode and heat sink assembly as a unit.

Removal

1. Remove cover plate from diode end frame.
2. Remove positive diode lead clip and disconnect three diode set leads from generator output terminal.

NOTE: On Integral type generator, disconnect regulator leads from each diode set.

3. Remove bolt and washer attaching negative diode set lead to generator frame.
4. Remove stator lead nut from heat sink, then remove heat sink to end frame mounting screws.
5. Remove diode and heat sink assembly from end frame.

Installation

1. Place sleeve insulators into heat sink mounting screw holes from underside of heat sink.
2. Position diode and heat sink assembly in end frame. Place lock washer, flat washer, and flat insulating washer on heat sink mounting screws. Install heat sink to end frame mounting screws and tighten firmly.
3. Install stator lead nut on stud and tighten firmly.
4. Position negative diode set lead on generator frame and attach with bolt and washer.
5. Position positive diode set leads on generator output terminal and secure with bolt and washer. Place clip over positive diode leads and secure to end frame with screw and washer.

NOTE: On integral type generator, install lead from diode mounted in end frame to generator output terminal and connect leads from regulator to each heat sink assembly as shown in figure 8.

NOTE: If no other parts are to be replaced, position diode end cover on end frame and attach with bolts and washers.

FIELD REPLACEMENT

Removal

1. Remove diode and heat sink assembly from end frame as described previously.
2. Remove six bolts and lock washers attaching diode end frame to stator frame.
3. Separate end frame from stator frame and withdraw end frame and field assembly from rotor, at the same time pushing stator lead studs out of end frame.
4. Remove nut, lock washer, flat washer, insulating washer, and sleeve securing field lead terminal stud in end frame. Push stud out of end frame.

NOTE: On integral type generator, disconnect field leads from regulator as explained under "Regulator Replacement" previously.

5. Remove four bolts and washers attaching field to end frame.
6. To separate field from end frame, install four 3/8-24 x 3" bolts in place of the 3/8-24 x 2" attaching bolts removed in Step 5. Thread bolts in to equal heights. Support end frame in arbor press, and using a suitable press plate to exert force on all four bolt heads, press field out of end frame.

Installation

1. Position field assembly at end frame, insert 3/8-24 x 3" bolts through end frame, and thread into field to keep holes aligned.
2. Support end frame on arbor press bed in such a manner that the diodes will not be damaged and press field into end frame. Press in until the shoulder on field core bottoms against end frame.
3. Remove the four guide bolts. Install four 3/8-24 x 2" bolts, using new lock washers, attaching field to end frame and tighten securely.
4. On non-integral type generator, place insulating sleeve in inner side of field terminal stud hole in end frame and insert terminal stud through sleeve. Place an O-ring, insulating sleeve, and another insulating washer over field terminal stud and push these parts into end frame. Install flat washer, toothed lock washer, and nut on terminal stud and tighten firmly.

On integral type generator, position field leads through slots in regulator cover plate gasket and attach to regulator terminals as shown in figure 8.

5. Install a stator lead stud through each diode and heat sink assembly; then install each diode and heat sink assembly on end frame as previously directed under "Diode Replacement." Place a washer and nut on each stator lead stud and tighten nut firmly.
6. Insert field into rotor and position end frame against stator frame. Attach end frame to stator frame with six bolts and washers. Tighten bolts firmly.
7. If no other parts require replacement, position diode end cover on end frame and secure with bolts and washers. Tighten end cover bolts firmly.

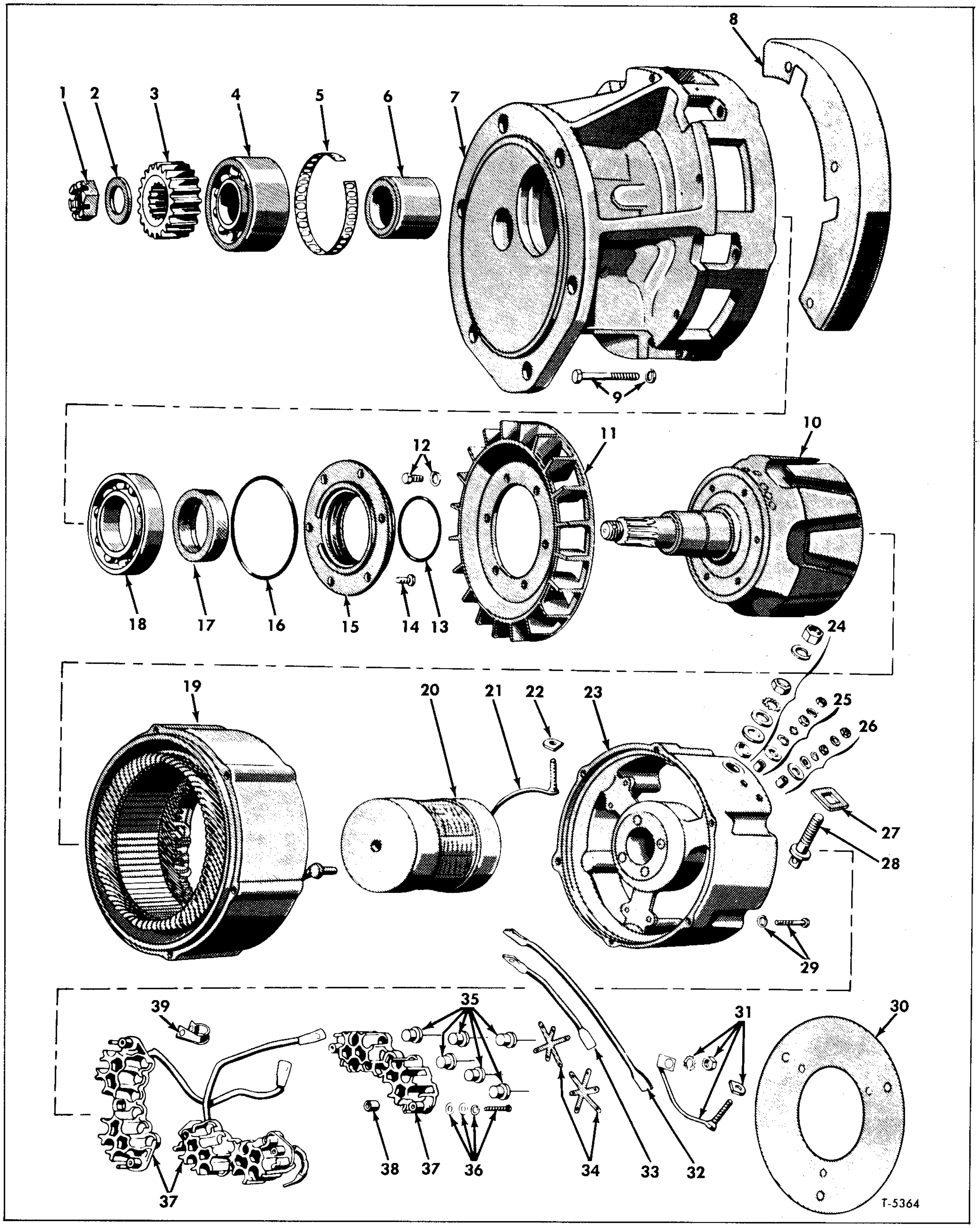


Figure 9—Generator Components (Typical)

1 Nut
2 Washer
3 Drive Gear
4 Drive End Frame Bearing
5 Tolerance Ring
6 Spacer
7 Drive End Frame
8 Shield
9 Drive End Frame to Stator Frame Bolt and Washer
10 Rotor and Shaft Assembly
11 Fan
12 Fan to Rotor Screw and Washer
13 O-Ring
14 Retainer to End Frame Screw
15 Bearing Retainer & Oil Seal
16 O-Ring
17 Collar
18 Bearing
19 Stator and Terminal Assembly
20 Field Assembly
21 Field Terminal
22 Insulator
23 Slip Ring End Frame Assembly
24 Relay Terminal Components
25 Field Terminal Components
26 D.C. Terminal Components
27 Terminal Insulator
28 Terminal Stud
29 Slip Ring End Frame to Stator Frame Bolt and Washer
30 End Frame Cover
31 Terminal Assembly
32 Connector Strap
33 Ground Terminal
34 Diode Connector Strap
35 Diode
36 Heat Sink to End Frame Mounting Screw, Lock Washer, Flat Washer, and Insulator
37 Heat Sink Assembly
38 Spacer
39 Terminal Clip

Legend for Figure 9

STATOR REPLACEMENT

If tests indicated an open circuit or short in the stator, the stator and frame assembly must be replaced.

Removal

1. Remove diode end frame and field assembly as previously directed in Steps 1 through 4 under "Removal" in "Field Replacement" procedure.
2. Remove six bolts and washers which attach stator frame to drive end frame.
3. Separate stator frame from drive end frame and remove from end frame and rotor.

Installation

1. Position stator and frame assembly over rotor and against drive end frame. Install six bolts and washers to attach stator frame to drive end frame.
2. Install diode end frame and field assembly as directed in Steps 4, 5, and 6 under "Installation" in "Field Replacement" procedure.
3. Position diode end cover on end frame and secure with bolts and washers. Tighten bolts firmly.

FAN, BEARING OR ROTOR REPLACEMENT

(Refer to Figure 9)

Whenever the rotor and drive end frame are disassembled for any reason, the single row ball bearing should be replaced due to the probability of tis being damaged during disassembly.

REMOVAL AND DISASSEMBLY

1. Remove nut and flat washer from end of rotor shaft, then pull driven gear off shaft.
2. Remove bolts and lock washers from fan shield, then remove shield from drive end frame.
3. Remove six bolts and lock washers attaching drive end frame to stator frame. Separate drive end frame from stator frame and remove drive end frame and rotor assembly.
4. Support drive end frame in arbor press in such a manner that the rotor can be pressed down out of end frame. Using a suitable adapter against end of rotor shaft which will pass through inner race of double-row bearing, press rotor down out of end frame and bearings. (Since the single-row bearing outer race is retained in the end frame by the retainer plate, and the inner race is a press fit on the rotor shaft, the bearing is likely to be damaged when the shaft is pressed out and must be replaced with a new part.)
5. Remove six screws and lock washers which attach fan to rotor and remove fan.
6. Remove six staked screws which attach bearing retainer plate to drive end frame. Remove retainer plate and oil seal, O-ring, collar, single-row bearing, and bearing spacer from end frame.
7. Support drive end frame in an arbor press, with double-row bearing down, in such a manner that the bearing can be pressed down out of end frame. Using a suitable driver, which will exert force on bearing outer race, press bearing out of end frame.
8. Remove tolerance ring from groove in end frame.

ASSEMBLY AND INSTALLATION

1. Press new single-row ball bearing into inner side of drive end frame with shielded side of bearing toward rotor.

IMPORTANT: Press against outer race of bearing when installing bearing in drive housing.

2. Place fan on rotor and attach with six screws and lock washers. Tighten screws firmly.

3. Position O-ring over rotor shaft against rotor.

4. Install oil seal in retainer with lip of seal toward the bearing, then install drive end frame inner bearing O-ring on retainer plate. Install collar and retainer plate on drive end frame.

IMPORTANT: Notch in retainer plate must be aligned with notch in end frame.

5. Install six screws to attach retainer plate to end frame. Tighten screws firmly and stake.

6. Place tolerance ring in groove in bore in drive end frame.

7. Position rotor in arbor press with shaft end up. Install drive end frame and single-row bearing assembly over rotor shaft. Using a driver over rotor shaft which will exert force on bearing inner race, press bearing onto shaft.

8. Install bearing spacer over rotor shaft with shoulder on spacer toward outer, double-row, bearing. Position double-row bearing over shaft at end frame bore. Using an adapter which will exert an even force on inner and outer races of bearing, press bearing onto shaft and into end frame until inner race bottoms against bearing spacer.

9. Insert rotor between stator and field, and position drive end frame against stator frame. Attach end frame to stator frame with six bolts and lock washers. Tighten bolts firmly.

10. Press driven gear onto rotor shaft, then install flat washer and nut. Tighten nut to 145-155 foot-pounds torque.

GENERATOR SPECIFICATIONS

COACH MODEL	PD-4108	PD-4905
GENERATOR		
Make	Delco-Remy	Delco-Remy
Model	1117687	1117685
Series	50SI	50DN
Type	500	500
Rotation	Clockwise	Clockwise
Field Current at 80°F.		
Amperes	5.7-6.2	5.7-6.2
Volts	24	24
Cold Output		
Specified Volts	28	28
Amperes	80	80*
Approximate Generator R.P.M.	1200	1200
Amperes	225	225*
Approximate Generator R.P.M.	2500	2500
Rated Hot Output	225	225
Generator Drive Ratio	2.75 to 1	2.75 to 1

*If Generator Output Is Checked Without a Regulator, the Output Should Be 5-10% Higher Than the Value Given.

REGULATOR SPECIFICATIONS

Coach Model	PD-4905
Regulator Make	Delco-Remy
Type	Transistorized
Model No.	9000597
Polarity	Negative Ground
Quantity of Transistors	
Power (Output)	2
Driver	1
Voltage Setting*	27.5

*See Text

Lighting System

Lighting system information for coaches covered by this supplement remains the same as covered under "LIGHTING SYSTEM" pages 191 through 201 in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814, except as follows:

GENERAL

Electrical circuits for all lights used for illumination are shown on applicable wiring diagrams in "Wiring Diagrams" booklet X-7014A.

Circuits for all lights used for regular illumination are shown on "Coach Lighting Wiring Diagram" (MD-6954 for PD-4108 Coach or MD-7150 for PD-4905 Coach).

Directional signals and tell-tale light circuits are shown on "Directional Lamp Wiring Diagram" (MD-6916 for PD-4108 Coach or MD-7149 for PD-4905 Coach).

Circuits for stop lights and tell-tale light are shown on "Alarm and Signal Wiring Diagram" (MD-9618 for PD-4108 Coach or MD-7173 for PD-4905 Coach).

Circuits for the flashing step lamp are shown on MD-6948 for PD-4108 Coach or MD-4609 for PD-4905 Coach.

Circuits for reading and general lights are shown on "Reading and General Lighting Wiring Diagram" (MD-7126 for PD-4108 Coach or MD-7148 for PD-4905 Coach).

Circuits for seat lamps are shown on "Seat Lamp Wiring Diagram" (MD-4611 for PD-4905 Coach).

SWITCHES AND CIRCUIT BREAKERS

The following lights are controlled by switches located on the right-hand side switch panel in front of driver or on driver's control panel to left of driver. Refer to figures 1 and 2 in "WIRING AND MISCELLANEOUS ELECTRICAL" section previously.

Reading and general lights and destination sign lights are controlled by separate toggle type switches marked "READ," "GNRL.," or "SIGN" located on right-hand side switch panel in front of driver.

The headlamps, tail lamps, marker lamps, license lamps, instrument panel lamps, and switch panel lamps are controlled by the main light switch marked "TAIL, MARK" and "HEAD, TAIL, MARK" located on right-hand side switch panel in front of driver.

The hazard warning flashing lights are controlled by a toggle switch located on the driver's instrument panel. Directional lights are controlled by a switch on the steering column.

Seat lamps (when used) and the driver's lamp are controlled by separate toggle switches located on the driver's control panel at left of driver.

Engine compartment, baggage compartment, lavatory, front step, and refrigerant receiver tank lights are controlled by secondary switches operated by door or manually.

Lighting circuits are protected by automatic reset type circuit breakers. Refer to "WIRING AND MISCELLANEOUS ELECTRICAL" section for location and rating of each circuit breaker.

EXTERIOR LIGHTING EQUIPMENT

HEADLIGHTS

Information applicable to headlights remains the same as covered under "Headlights" pages 191 through 193 in "LIGHTING SYSTEM" in ELECTRICAL SYSTEM (SEC 7) in Maintenance Manual X-6814 except as follows:

Safety aimer (J-6878-01) should be used for adjusting headlight. Instructions for using the safety aimer are supplied by the instrument manufacterer.

On PD-4108 model coach, headlight low beam circuit is energized from generator "AC" (relay) terminal through No. 7 circuit breaker on engine compartment apparatus panel and No. 21 and No. 22 circuit breakers on driver's control panel whenever engine is running and generator is charging. This will provide 12-volts to the headlamp low beam circuit causing headlamps to illuminate at approximately half intensity during daylight operation.

On PD-4905 model coach, headlight low beam circuit is energized from generator "R" (relay) terminal through No. 6 circuit breaker on engine compartment apparatus panel and No. 3 and No. 4 circuit breakers in tool compartment whenever engine is running and generator is charging. This will provide 12 volts to the headlamp low beam circuit causing headlamps to illuminate at approximately half intensity during daylight operation.

Full low beam intensity is obtained by placing the main light switch, located on right-hand side switch panel, in either "ON" position.

HEADLAMP SWITCH

Light switch, mounted on right-hand side switch panel in front of driver, controls the headlamps, tail lamps, marker lamps, license lamps, instrument panel lamps, and switch panel lamps. Electrical circuits and connections are shown on applicable "Coach Lighting Wiring Diagram."

Switch Replacement

1. Remove two screws which attach right-hand side switch panel to instrument panel.
2. Pull switch panel out far enough to reach switch wiring. Clearly identify wires to ensure proper position when installing switch, then disconnect wiring from switch.
3. Remove hex nut attaching switch to switch panel, then replace the switch.

HEADLIGHT DIMMER SWITCH

A foot-operated dimmer switch is used to select headlight high or low beam. Switch is mounted on floorboard near clutch pedal and is operative when headlights are illuminated.

Switch requires no maintenance, however, switch may be replaced by removing screws which attach switch mounting plate to floor. Remove screws which attach switch to mounting plate. Position new switch in mounting plate, then referring to applicable "Lighting System Wiring Diagram" in "Wiring Diagrams" booklet X-7014A, disconnect switch wiring from driver's control panel junctions. Connect wires from new switch to respective terminals on driver's control panel junction block. Position switch mounting plate on floor and install screws to attach.

NOTE: If switch wires were not marked for identification, refer to applicable "Coach Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

STOP, TAIL, DIRECTIONAL, AND HAZARD WARNING LIGHTS

Individual stop, tail, and directional lights are used on these coaches. At rear of coach, directional lights are mounted at outer edge of engine compartment door and stop and tail lights are to the inside. Side directional lights are mounted to rear of front door and on opposite left-hand side.

The hazard warning flashing system utilizes the front, side, and rear directional lamps. This system is energized by a switch on driver's instrument panel marked "HAZARD WARN. FLASHER." When switch is placed in "ON" position, front, side, and rear directional lights and directional tell-tale lights will flash simultaneously until switch is placed in "OFF" position.

STOP LIGHT SYSTEM

Information applicable to the stop light system remains the same as covered under "Stop Light System" on page 195 in "LIGHTING SYSTEM" in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814 except as follows:

On PD-4108 model coach, stop light system is protected by No. 14 circuit breaker on apparatus panel at left of driver. On PD-4905 model coach, stop light system is protected by No. 22 circuit breaker on apparatus panel at left of driver.

STOP LIGHT SWITCH

NOTE: Five and a half psi air pressure is required on piston to overcome piston spring tension.

TAILLIGHT SYSTEM

Taillights are mounted in engine compartment door between stop and directional signal lights. Taillights are illuminated by light switch on the right-hand side switch panel in front of driver.

LICENSE PLATE LIGHTS

Two license plate lights are mounted above the license plate. Lights are operative when light switch on the right-hand side switch panel in front of driver is placed in either "ON" position.

BACK-UP LIGHTS

On PD-4108 model coach, the back-up light circuit is fed from the engine run switch through the engine run magnetic switch No. 18 circuit breaker on driver's control and apparatus panel and No. 6 circuit breaker on engine compartment apparatus panel.

On PD-4905 model coach, the back-up light circuit is fed from the engine run switch through the engine run relay No. 2 circuit breaker on driver's control and apparatus panel and No. 5 circuit breaker on engine compartment apparatus panel.

The back-up lamp switch, mounted on the transmission, is actuated by the reverse shift rail when engine run switch is in "RUN" position and "REVERSE" switch on left-hand side switch panel in front of driver is in "ON" position. Transmission shift lever must be in 1st speed position before reverse switch can be energized.

HAZARD WARNING FLASHING SYSTEM

Hazard warning flashing system consists of two directional lights at rear of coach, two directional signal lights at front of coach, and two side directional signal lights. System is operated by "HAZARD WARN. FLASHER" switch located on instrument panel and flashing cycle is controlled by a flasher mounted on heater and defroster right-hand side panel. The hazard warning flashing system circuit is shown on applicable "Directional Lamp Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

OPERATION

When "HAZARD WARN. FLASHER" switch is placed in "ON" position, circuit is completed from driver's control and apparatus panel No. 11 circuit breaker (PD-4108 coach) or No. 17 circuit breaker (PD-4905 coach) through the flasher unit and switch to directional signal and directional tell-tale lights.

CLEARANCE & SIDE MARKER LIGHTS

A combination lamp is mounted at each corner of coach near top. Marker light circuits are energized with light switch on right-hand side switch panel in front of driver in either "ON" position. Light bulbs are accessible after removing lens from lamp housing.

IDENTIFICATION LIGHTS

Six identification lights are mounted - three at rear of coach above window and three at front of coach above destination sign. Light circuits are energized when light switch on right-hand side switch panel in front of driver is in either "ON" position. Rear light bulbs are accessible for replacement after removing screw attaching lens to body. Front light bulbs are accessible by lowering front destination sign door. Pull socket from lamp body and replace bulb.

FRONT AND SIDE DESTINATION SIGN LIGHTS

Information applicable to front and side destination sign lights remains the same as covered on pages 197 and 198 in "LIGHTING SYSTEM" in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814 except that sign lights on PD-4108 model coach are protected by No. 7 circuit breaker on apparatus panel at left of driver.

INTERIOR LIGHTING EQUIPMENT

INSTRUMENT PANEL LIGHTS

Gauges on instrument panel in front of driver are illuminated when light switch on right-hand switch panel in front of driver is in either "ON" position. Instrument panel lights are protected by Nos. 2, 3, and 6 (10-Amp) circuit breakers on apparatus panel at left of driver (PD-4108 model coach) and by Nos. 9, 10, and 15 (10-Amp) circuit breakers on apparatus panel at left of driver on PD-4905 model coach. Refer to applicable "Coach Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Light bulbs are accessible by pulling bulb socket from back of panel. Bulb can then be removed from socket. After replacing bulb, press socket firmly into back of panel housing.

STEPWELL LIGHT

Information applicable to the stepwell light remains the same as covered on page 198 in "LIGHTING SYSTEM" in ELECTRICAL SYSTEM (SEC. 7) in Maintenance Manual X-6814 except the step lamp circuit on PD-4108 model coach is protected by No. 20 circuit breaker on apparatus panel at left of driver.

Refer to applicable "Flashing Step Lamp Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

GENERAL AND READING LIGHTS

General interior and reading lights are mounted on package racks, and are controlled by "READ" switch and "GNRL." switch on right-hand side switch panel in front of driver.

GENERAL LIGHTS (MODEL PD-4108)

With switch in "GNRL." position circuit is completed from No. 5 circuit breaker on apparatus panel at left of driver through the operating coil (terminal No. 3) of the general lamp relay mounted on intermediate relay and junction panel. When relay coil is energized, contact points close and complete circuit to the general lights through Nos. 4 and 5 circuit breakers on intermediate relay and junction panel.

Refer to applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

GENERAL LIGHTS (MODEL PD-4905)

With switch in "GNRL." position, circuit is completed from No. 14 circuit breaker on apparatus panel at left of driver through operating coil (terminal No. 3) of the general lamp relay mounted on the regulator and apparatus panel. When relay operating coil is energized, contact points close and complete circuit to the general lights through Nos. 4 and 5 circuit breakers on regulator and apparatus panel.

Refer to applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

READING LIGHTS (MODEL PD-4108)

With switch in "READ." position, circuit is completed from No. 5 circuit breaker on apparatus panel at left of driver through operating coil (terminal No. 3) of reading lamp relay mounted on intermediate relay and junction panel. When relay operating coil is energized, contact points close and complete circuit to the individual reading lamp switches through Nos. 2 and 3 circuit breakers on intermediate relay and junction panel. Reading lights can then be turned on by individual switches located in base of lamp.

Refer to applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

READING LIGHTS (MODEL PD-4905)

With switch in "READ." position, circuit is completed from No. 14 circuit breaker on apparatus panel at left of driver through operating coil (terminal No. 3) of reading lamp relay mounted on regulator and apparatus panel. When relay operating coil is energized, contact points close and complete circuit to the individual reading lamp switches through Nos. 2 and 3 circuit breakers on regulator and apparatus panel. Reading lights can then be turned on by individual switches located in base of lamp.

Refer to applicable "Reading and General Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

NIGHT LIGHTS

Four night lamps are used on these coaches. One night lamp is mounted on the left front seat to illuminate the step and one night lamp is mounted on the left rear seat to illuminate the lavatory entrance. In addition, a front and rear package rack night lamp is used to provide additional interior illumination. Lamps are illuminated by placing light switch on right-hand side switch panel in front of driver in either "ON" position.

Refer to applicable "Coach Lighting Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

An additional night lamp located on second left-hand seat is controlled by the entrance door switch. Refer to applicable "Flashing Step Lamp Wiring Diagram" for circuitry.

DRIVER'S LIGHT

Driver's lamp, mounted on trim panel above driver's window, is controlled by placing switch marked "DRIVER'S LAMP" on driver's control panel at left of driver in "ON" position. Driver's lamp circuit is protected by No. 4 circuit breaker on apparatus panel at left of driver on PD-4108 model coach and by No. 21 circuit breaker on apparatus panel at left of driver on PD-4905 model coach.

Electrical circuitry is shown on applicable "Coach Lighting Wiring Diagram." Bulb is accessible after removing retainer and lens which is secured to lamp body with three screws.

BAGGAGE COMPARTMENT LIGHTS

Baggage compartment lights are controlled by individual switches as each door is opened and closed. Compartment light circuit is protected by No. 8 circuit breaker (PD-4108 coach) or No. 18 circuit breaker (PD-4905 coach) on apparatus panel at left of driver. Refer to applicable "Coach Lighting Wiring Diagram" for electrical circuits. To replace bulbs, remove two mounting screws. Pull bulb and socket from body and replace bulb.

"WATCH STEP" SIGN LIGHTS

The "WATCH STEP" sign lights located in padded ledge beneath "Astralite," night lamp located on second seat, left-hand side, and "WATCH STEP" aisle lamps (when used) are controlled by "ENG." switch on left-hand side switch panel in front of driver. With switch in "ENG." position, engine run magnetic switch (PD-4108 Coach) or engine run relay (PD-4905 Coach) is energized, completing circuit to entrance door switch and through relay points to lights. This circuit is protected by No. 20 circuit breaker (PD-4108 Coach) or No. 5 circuit breaker (PD-4905 Coach) on apparatus panel at left of driver. With entrance door open, entrance door switch contacts close completing circuit through flashing step lamp relay coil windings. With windings energized, circuit is completed through flasher to lights. Lights flash at a steady cycle until entrance door is closed.

To replace bulbs in "WATCH STEP" sign, snap lens out of housing and pull bulbs from retaining clips.

LAVATORY COMPARTMENT LIGHTS

MODEL PD-4108 COACH

Fluorescent mirror lamp is energized through No. 5 circuit breaker on engine compartment apparatus panel through the lavatory relay, lavatory door switch, and No. 17 circuit breaker on apparatus panel at left of driver when engine run switch is in "ENG." position.

When engine run switch is placed in "ENG." position, circuit is completed through No. 17 circuit breaker on apparatus panel at left of driver and lavatory door switch to energize lavatory relay operating coil winding. With winding energized, contact points will close to complete circuit from No. 5 circuit breaker on engine compartment apparatus panel to fluorescent mirror lamp.

When door is closed and locked, current from No. 1 circuit breaker on intermediate relay and junction panel will flow through the lavatory door switch to energize the occupied sign lights and lavatory relay operating coil winding to complete circuit to the fluorescent mirror lamp.

MODEL PD-4905 COACH

Fluorescent mirror lamp is energized through No. 1 circuit breaker on engine compartment apparatus panel through the lavatory relay, lavatory door switch, and No. 1 circuit breaker on apparatus panel at left of driver when engine run switch is in "ENG." position.

When engine run switch is placed in "ENG." position, circuit is completed through No. 1 circuit breaker on apparatus panel at left of driver and lavatory door switch to energize lavatory relay operating coil winding. With winding energized, contact points will close to complete circuit from No. 1 circuit breaker on engine compartment apparatus panel to fluorescent mirror lamp.

When door is closed and locked, current from No. 1 circuit breaker on regulator and apparatus panel will flow through lavatory door switch to energize the occupied sign lights and lavatory relay operating coil winding to complete circuit from No. 1 circuit breaker on engine compartment apparatus panel to fluorescent mirror lamp.

Refer to applicable "Lavatory Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

Refer to Next Page For Light Bulb Data.

LIGHT BULB DATA

DESCRIPTION	QTY.	CANDLE-POWER OR WATTS	TRADE NO.
Headlamp Sealed—Beam Unit			
(Inside—Stamped No.1)	2	50W	4619
(Outside—Stamped No.2)	2	50W	4624
Front Corner Marker Lamps	2	6	623
Front Identification Marker Lamps	3	3	1251
Side Identification Marker Lamps	2	6	623
Front Directional Signal Lamps	2	32	1683
Side Directional Signal Lamps	2	32	1683
Rear Directional Signal Lamps	2	32	1683
Rear Stop Lamps	2	32	1683
Rear Tail Lamps	2	3	1251
Rear License Lamps	2	3	1251
Back-up Lamps	2	32	1683
Rear Corner Marker Lamps	2	6	623
Rear Identification Marker Lamps	3	3	1251
Entrance Door Lamp	1	21	1203
Entrance Door "Watch Step" Lamp	2	2	456
"Watch Step" Warning Lamp	2	6	212
Driver's Lamp	1	15	1692
Speedometer Gauge Lamp	1	2	456
Oil Gauge Lamp	1	2	456
Air Gauge Lamp	1	2	456
Temperature Gauge Lamp	1	2	456
Voltmeter Gauge Lamp	1	2	456
*Fuel Gauge Lamp	1	2	456
Directional Tell-Tale Lamp (Green)	2	1090-D92	676311
Low Air Tell-Tale Lamp (Red)	1	1090-D92	676310
Water Tell-Tale (Red)	1	1090-D92	676310
Low Oil Tell-Tale (Red)	1	1090-D92	676310
Transmission Oil Tell-Tale (Red)	1	1092-D92	676310
Stop Lamp Tell-Tale (Red)	1	1090-D92	676310
A/C Stop Tell-Tale (Red)	1	1090-D92	676310
Hi-Beam Tell-Tale (Blue)	1	1090-D92	676312
Switch Panel Lamps	2	0.34	334
Destination Sign Lamp	4	15	1691
Reading Lamps			
Model PD-4108	36	15	1691
Model PD-4905	44	15	1691
General Lamps			
Model PD-4108	12	15	1309
Model PD-4905	14	15	1309
*Lavatory Occupied Sign Lamp	2	2	456
*Lavatory Fluorescent Mirror Lamp	1	—	24-T-12
Package Rack Night Lamp—Front and Rear—Blue Coating	2	2	456
Night Lamp on Second L.H. Seat—(Blue Coating)	1	2	456
Front and Rear L.H. Seat Night Lamp (Blue Coating)	2	2	456
Baggage Compartment Lamps			
Model PD-4108	4	21	1203
Model PD-4905	6	21	1203
Engine Compartment Lamps	4	15	1691
Freon Tank Lamp	1	15	1691

*Special Equipment

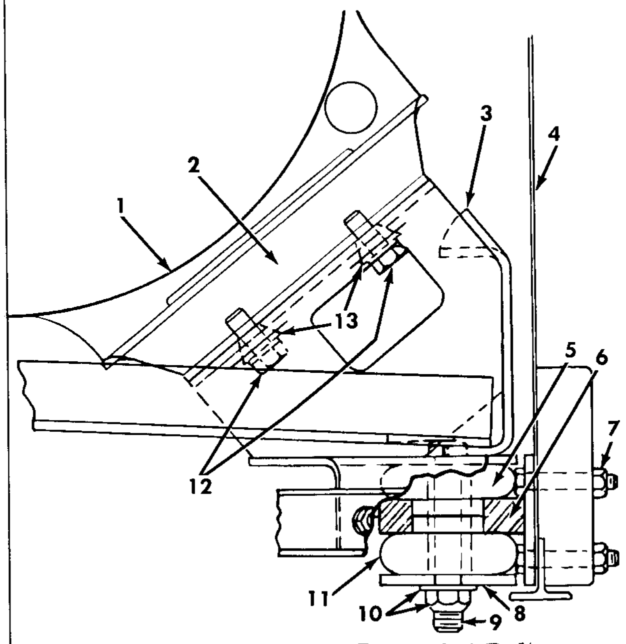
SECTION 8

Engine

All information in DIESEL ENGINE (SEC. 8) in Maintenance Manual X-6814, pages 203 through 214 also applies to vehicles covered by this supplement except as specifically stated in the following procedures:

ENGINE CRADLE MOUNTING

The engine and cradle assembly is supported at the engine compartment bulkhead by two separate mounts. Each mount consists of an upper and a lower cushion (5 and 11, fig. 1) and a cradle support bracket (6, fig. 1) which is bolted to the engine compartment bulkhead (4). If cushions become deteriorated or oil soaked, remove bolt, nut, and washer (9 and 10) from mount. Raise engine and cradle with jack high enough to remove upper cushion. Also remove lower cushion and replace both cushions with new parts. Install bolt and tighten nut and washer to 120-150 foot-pounds torque.



1 Engine Flywheel Housing
2 Engine Rear Mounting
3 Cradle Assembly
4 Engine Compartment Bulkhead
5 Cradle Upper Cushion
6 Cradle Support Bracket
7 Bracket Bolts
8 Retainer Washer
9 Cradle-to-Bulkhead Bracket Bolt
10 Nut and Washer
11 Lower Cushion
12 Cradle-to-Mounting Bolt
13 Locating Washer

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Figure 1—Engine Cradle Mounting at Bulkhead

Figure 3 shows location of mountings on bulkhead with engine removed from coach. Except for the disconnecting of these mounts the "Power Plant Removal" procedure in Maintenance Manual X-6814 also applies to vehicles covered by this supplement.

ENGINE HANGER ASSEMBLY

REPLACEMENT (Refer to Fig. 2)

1. Support engine cradle from below on suitable jack.
2. If any units (such as oil filter, water filter, hydraulic steering reservoir, etc.) are mounted on the hanger they should be removed before removing attaching bolts.
3. Remove hanger to cradle nut and bolt.
4. Remove hanger to window strainer nut and bolt.
5. If necessary to replace isolater assembly, remove isolater from hanger using suitable press and install new isolater using suitable press. Tighten nut to 70-90 foot-pounds torque.
6. To install hanger, insert upper bolt through

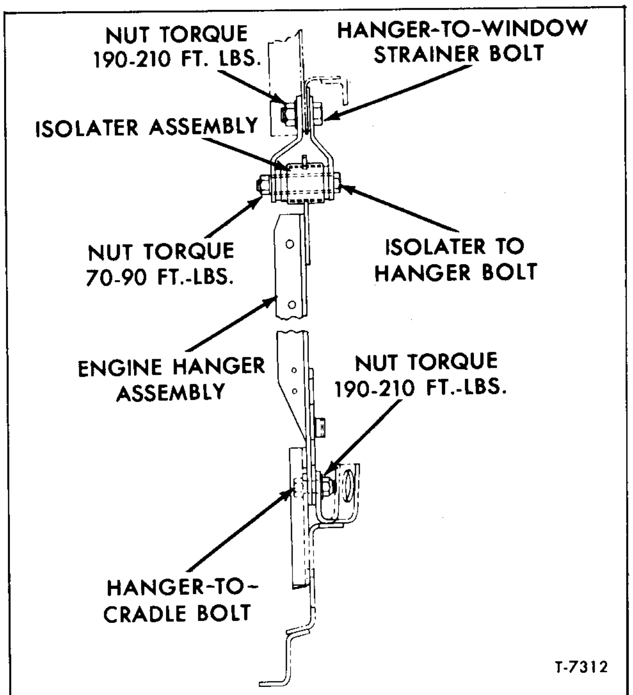
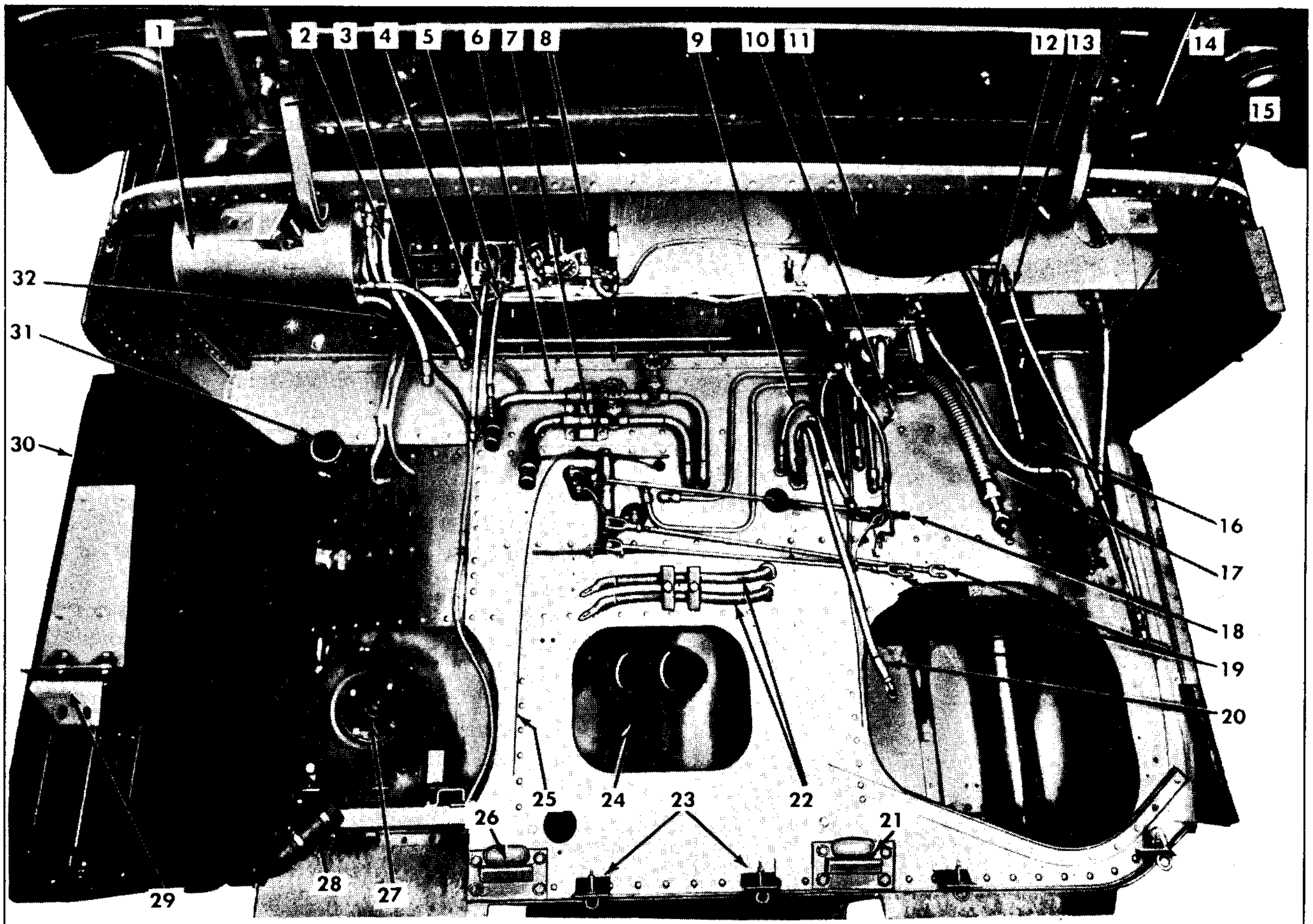

NUT TORQUE 190-210 FT. LBS.
HANGER-TO-WINDOW STRAINER BOLT
ISOLATER ASSEMBLY
NUT TORQUE 70-90 FT.-LBS.
ISOLATER TO HANGER BOLT
ENGINE HANGER ASSEMBLY
NUT TORQUE 190-210 FT.-LBS.
HANGER-TO-CRADLE BOLT
T-7312

Figure 2—Power Plant Rear Hanger Installation



1 Surge Tank
2 Deaeration Line
3 Vent Line
4 Idle Limiting Air Line
5 Engine Stop Air Line
6 Heater Feed Line
7 Heater Return Line
8 Electrical Junction Block
9 Fuel Return Line
10 Generator Electrical Harness
11 Engine Air Cleaner
12 Oil Pressure Line
13 Air Compressor Governor Line
14 Engine Compartment Door Prop
15 Power Steering Return Line
16 Power Steering Line
17 Air Compressor Discharge Line
18 Clutch Control Rod
19 Transmission Control Rods
20 Fuel Supply Line
21 Engine Cradle Support - Right
22 Battery Cables
23 Dust Shield Retainers
24 Engine Exhaust Muffler
25 Accelerator Cable
26 Engine Cradle Support - Left
27 Air Conditioner Compressor
28 Radiator Outlet
29 Radiator Support Bracket
30 Radiator
31 Radiator Inlet
32 Water Pump Return Line

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Figure 3—Engine Compartment Showing Disconnect Points

window strainer and hanger assembly. Tighten nut to 190-210 foot-pounds torque.

7. Insert lower bolt through cradle and hanger assembly. Tighten nut to 190-210 foot-pounds torque.

8. Install any units previously removed.

9. Remove jack from under cradle.

See Next Page For "Specifications."

DIESEL ENGINE SPECIFICATIONS

OIL PRESSURE SENDING UNIT	
Make	AC
Model	6460137
Resistance (Ohms) 0-3	0 P.S.I.
Resistance (Ohms) 7.5-13.5	10 P.S.I.
Resistance (Ohms) 84-93	80 P.S.I.
LOW OIL PRESSURE SWITCH	
Make	J. W. Hobbs Corp.
Model	674422
Contact Break (Lbs. Pressure)	7½-8½
Electrical Rating	4 amps.
AIR COND. OIL PRESSURE SWITCH	
Make	AC
Model	5653937
Switch Break (Lbs. Pressure)	23-27
ENGINE STOP AND FAST IDLE SOLENOID VALVES	
Make	Skinner Elec. Valve Div.
Model (Stop)	V5-30920-24V
Plunger Spring Approx. Free Height	11/32"
Model (Fast Idle)	V5-30690-24V
Plunger Spring Approx. Free Height	3/8"
TORQUE WRENCH SPECIFICATIONS (FT. LBS.)	
Front Engine Mount To Cradle Bolt Nut	50-60
Engine Stabilizer Eye Bolt Nut	
At Flywheel Housing	100-120
At Cradle Front Member	80-90
At Cradle Rear Member	190-210
Cradle Support Hanger Upper Bolt Nut	70-90
Cradle Support Hanger Lower Bolt Nut	190-210
Cradle To Bulkhead Mounting Bolt Nut	75-85
Cradle Hanger Upper Yoke Bolt Nut	190-210

SECTION 12

Fuel System

All information in FUEL SYSTEM (SEC. 12) in Maintenance Manual X-6814, pages 215 through 222 is applicable to models covered by this Supplement. The following information and illustration also apply:

ACCELERATOR AND LINKAGE

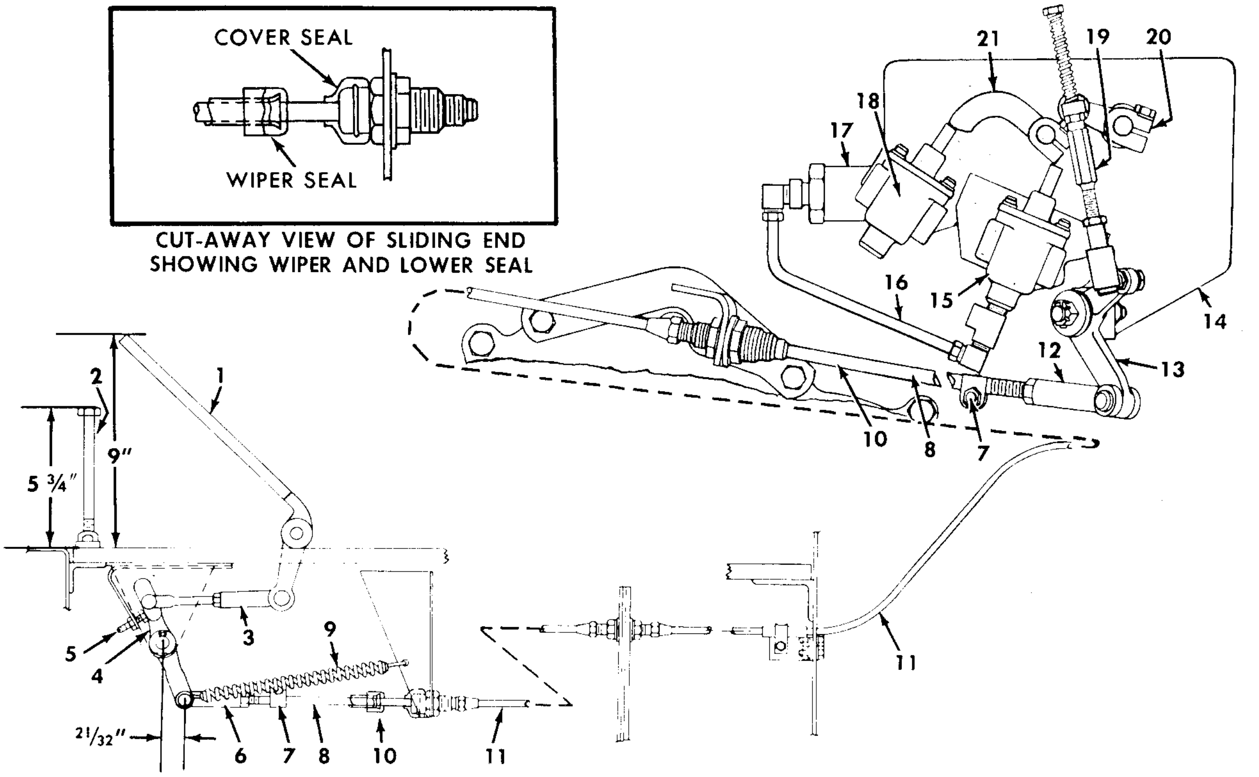
Accelerator pedal is connected to governor lever at engine by rods, levers and flexible cable which is encased in steel wire stranded flexible housing with nylon cover and acetal (Delrin) liner.

Figure 1 shows construction of accelerator linkage. Cut-away view shows dust and wiper seals.

The wiper seal and cover seal is used on sliding end assembly to keep sliding tube clean. For service and replacement refer to Accelerator Cable maintenance, pages 217 through 220 in X-6814.

NOTE: Bellows type boots are not used to cover sliding end on models covered by this supplement and information pertaining to them may be disregarded.

See Next Page For "Specifications."



1 Accelerator Pedal
2 Pedal Stop Screw
3 Adjustable Yoke
4 Idler Lever
5 Stop Screw
6 Adjustable Yoke
7 Cable Lock Clamp
8 Sliding Tube (Outer)
9 Return Spring
10 Sliding End Assembly
11 Cable Conduit
12 Adjustable Yoke
13 Governor Bell Crank
14 Governor Cover
15 Fast Idle Control Cylinder
16 Air Transfer Tube
17 Fast Idle Cylinder
18 Engine Stop Cylinder
19 Throttle Yield Linkage
20 Throttle Lever
21 Stop Lever

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Figure 1—Accelerator Pedal Linkage

SPECIFICATIONS

FUEL FILTER	
Primary	
Make	AC
Model	T-74
Type	Replaceable Element
Element Model	T-552
Secondary	
Make	AC
Model	T-65
Type	Replaceable Element
Element Model	TP-540X
AIR CLEANERS	
Number Used	1
Make	Donaldson
Type	Oil Bath
Capacity	6 Qts.
FUEL TANK	
Capacity—Standard	145 gal.
—Optional	165 gal.

SECTION 13

Lubrication

All information contained in LUBRICATION (SEC. 13) in Maintenance Manual X-6814 also applies to vehicles covered by this supplement, except as specifically stated in this section.

NOTE: Lubrication Chart is located at end of this supplement.

ENGINE OIL (SYMBOL "E" ON CHART)

RECOMMENDATIONS (MIL-L-2104B Lubricant)

GMC engines have given optimum performance, and experienced longest service life with MIL-L-2104B, S.A.E. 30 oils. However, the additive concentration of some MIL-L-2104B oils has been substantially increased in order to meet the performance requirements. Some of these 1968-1969 MIL-L-2104B oils have given unsatisfactory performance because of excessive exhaust valve and ring-belt ash deposits.

For these reasons our primary lubricant recommendations are MIL-L-2104B and Supplement 1 oils with the following limitations:

1. Zinc, as zinc diorganodithiophosphate, between a minimum of 0.07 and a maximum of 0.10 per cent by weight.

2. Sulfated ash (ASTM D-874) of 1.00 per cent maximum by weight, except lubricants that contain only barium detergent - dispersants where 1.50 per cent by weight is allowed.

Contact a reliable oil supplier and obtain his assurance that his product has been tested and given good performance in GMC engines. An S.A.E. 30 oil is recommended for year-round use. The use of lower viscosity oils or multigrade products will usually result in less than normal engine life.

MULTI-PURPOSE GREASE (SYMBOL "MPG" ON CHART)

FORMER "C" - REPLACED BY "MPG" ON CHARTS

Multi-Purpose Grease indicated by the Symbol "MPG" on chart in this manual should be a good quality lithium soap Multi-Purpose High Temperature Extreme Pressure Grease which meets GM Specification GM 6031M.

MULTI-PURPOSE GEAR OIL (SYMBOL "MPO" ON CHART)

FORMER "MP" - REPLACED BY "MPO" ON CHARTS

Multi-Purpose Gear Oil meeting U.S. Army Ordnance Specifications MIL-L-2105B and/or A.P.I. GL-5 and indicated by the Symbol "MPO" on Lubrication Chart in this supplement.

RADIATOR SHUTTER FLUID (SYMBOL "S13" ADDED ON CHART)

Fluid indicated by Symbol "S13" on chart, is a special shutter fluid, available from your GMC Warehouse.

SHUTTER AIR FLUID

At intervals indicated on Lubrication Chart, remove plug at top of filter reservoir and inject one and one-half ounce of fluid. Do not use a larger quantity, or at more frequent intervals than specified. Install and tighten plug.

SPECIAL GREASE (SYMBOL "S17" ADDED TO THIS SECTION)

A semi-fluid grease having extreme pressure properties and containing zinc oxide.

At regular lubrication intervals, or whenever accessible during repairs or overhaul, apply lubricant sparingly.

In addition to items listed, many other units use this lubricant, at time of assembly after overhaul, as indicated in various sections of this supplement or manual X-6814.

Body Door Handle Shaft Assembly
Body Baggage Compartment
Door Locks
Linkages
Strikers
Lock Pads
Air Cylinder Ends

SECTION 14

Air Suspension

All information on "Main Suspension System" and "Retractable Rear Axle" in X-6814, pages 223 through 274 is applicable to models covered by this supplement. The following information and illustrations also apply:

MAIN SUSPENSION SYSTEM

FRONT AXLE STABILIZER BAR

The stabilizer bar and links have been removed from the rear axle (fig. 1) and placed on the front axle (fig. 2).

For removal of stabilizer bar and links, refer to Maintenance Manual X-6814, page 237. For installation, refer to page 239 and "Stabilizer Bar" on pages 242 and 243.

TORQUE SPECIFICATIONS

Figure 8 illustrates Stabilizer Bar Component Torques.

FRONT SUSPENSION COMPONENTS

	Ft.-Lbs.
Stabilizer Bar Bar Bracket to Anchor Plate Bolt Nut	20-25
Stabilizer Bar Retainer Clamp Bolt Nut	25-30
Stabilizer Bar Link Nut	175 Min.

ALL TORQUES ON FIGURES 3 THROUGH 9 ARE IN FOOT-POUNDS.

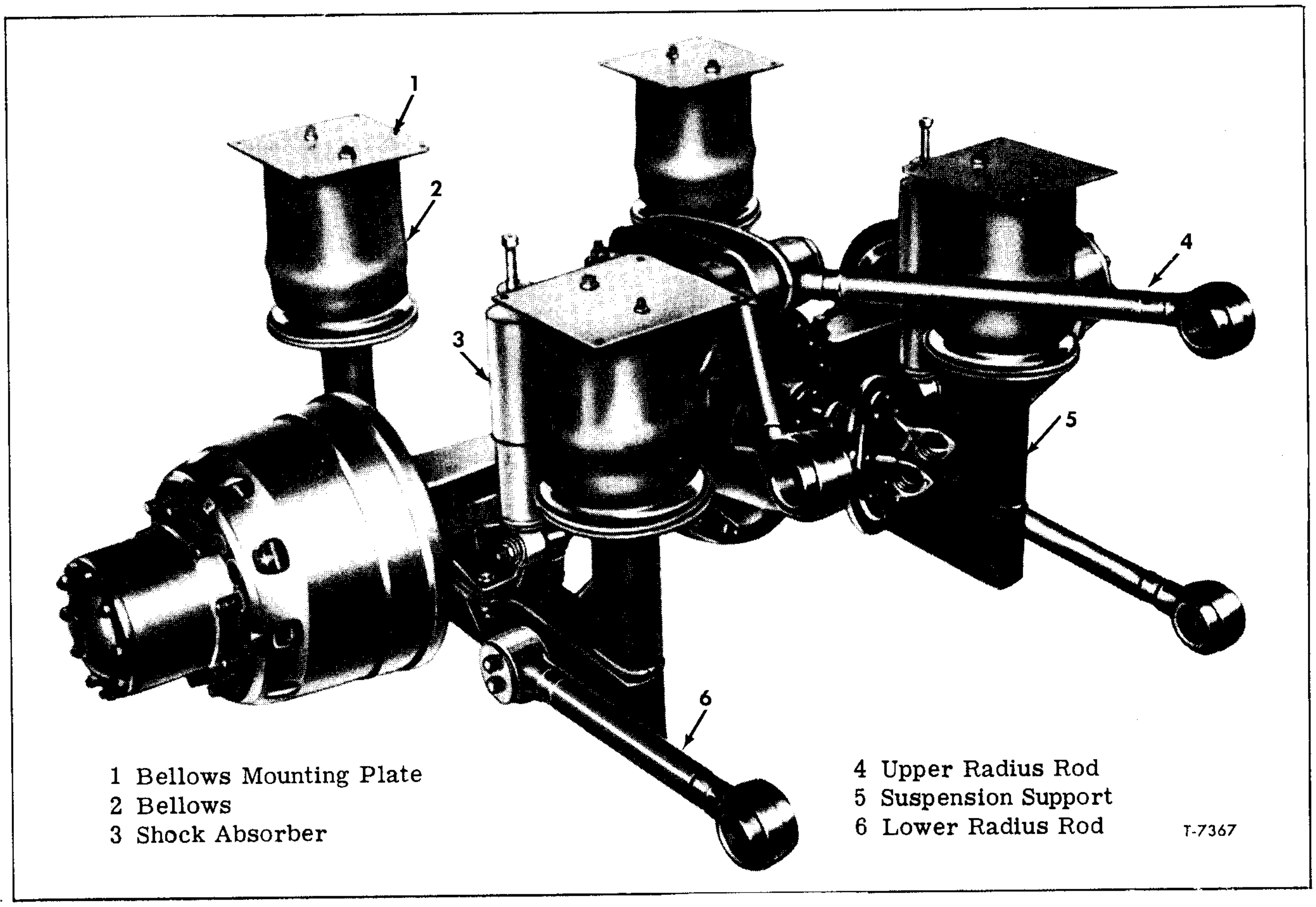
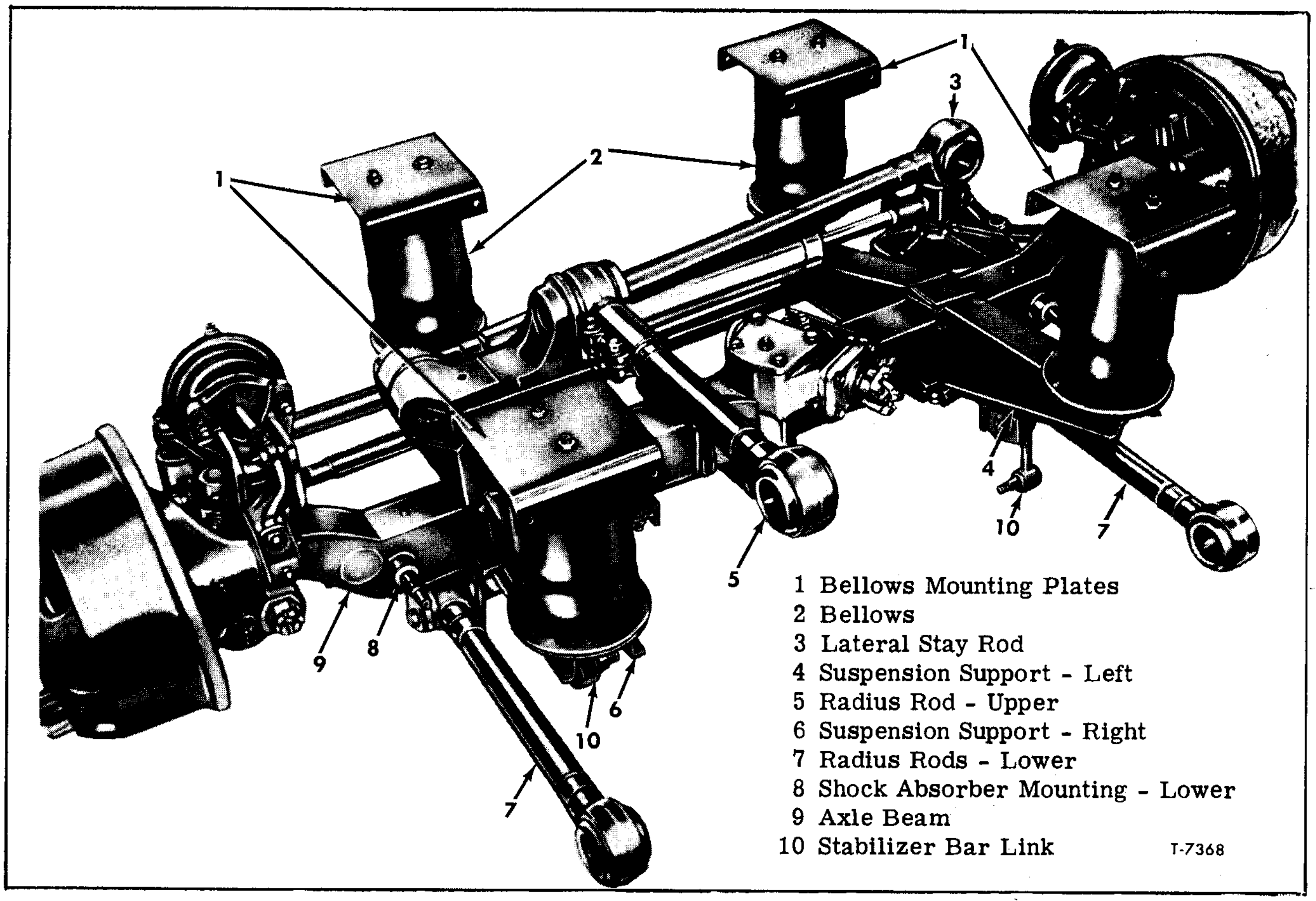


Figure 1—Rear Axle and Suspension Units



1 Bellows Mounting Plates
2 Bellows
3 Lateral Stay Rod
4 Suspension Support - Left
5 Radius Rod - Upper
6 Suspension Support - Right
7 Radius Rods - Lower
8 Shock Absorber Mounting - Lower
9 Axle Beam
10 Stabilizer Bar Link

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Figure 2—Front Axle and Suspension Units

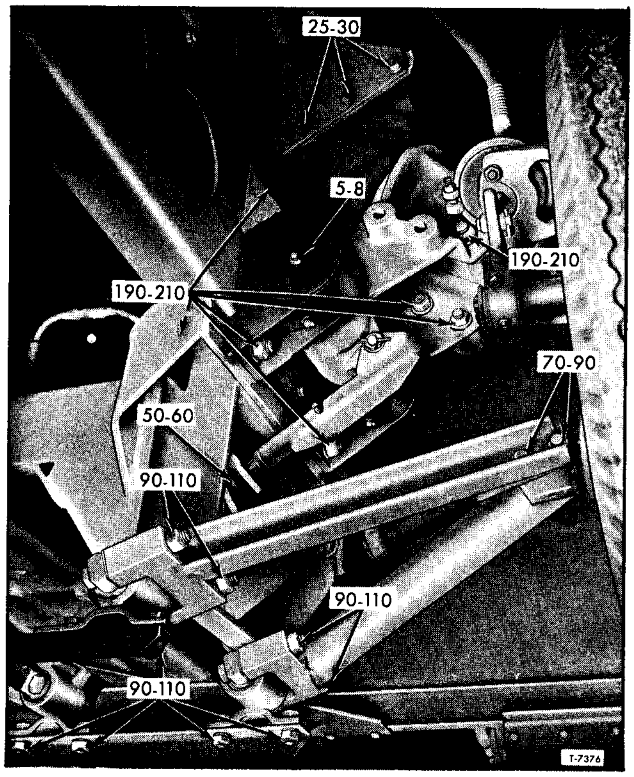
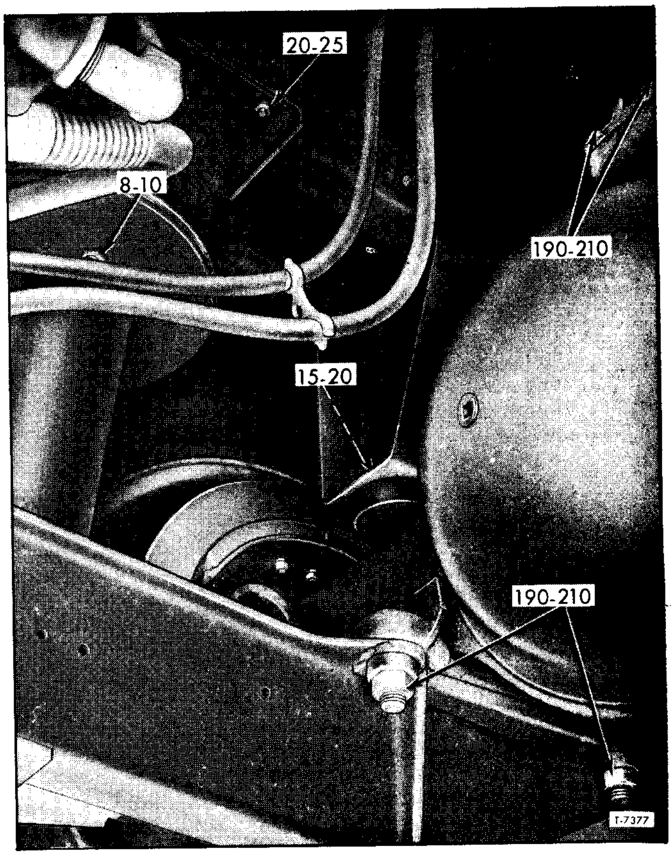


Figure 3—Retractable Axle

Figure 4—Rear Axle



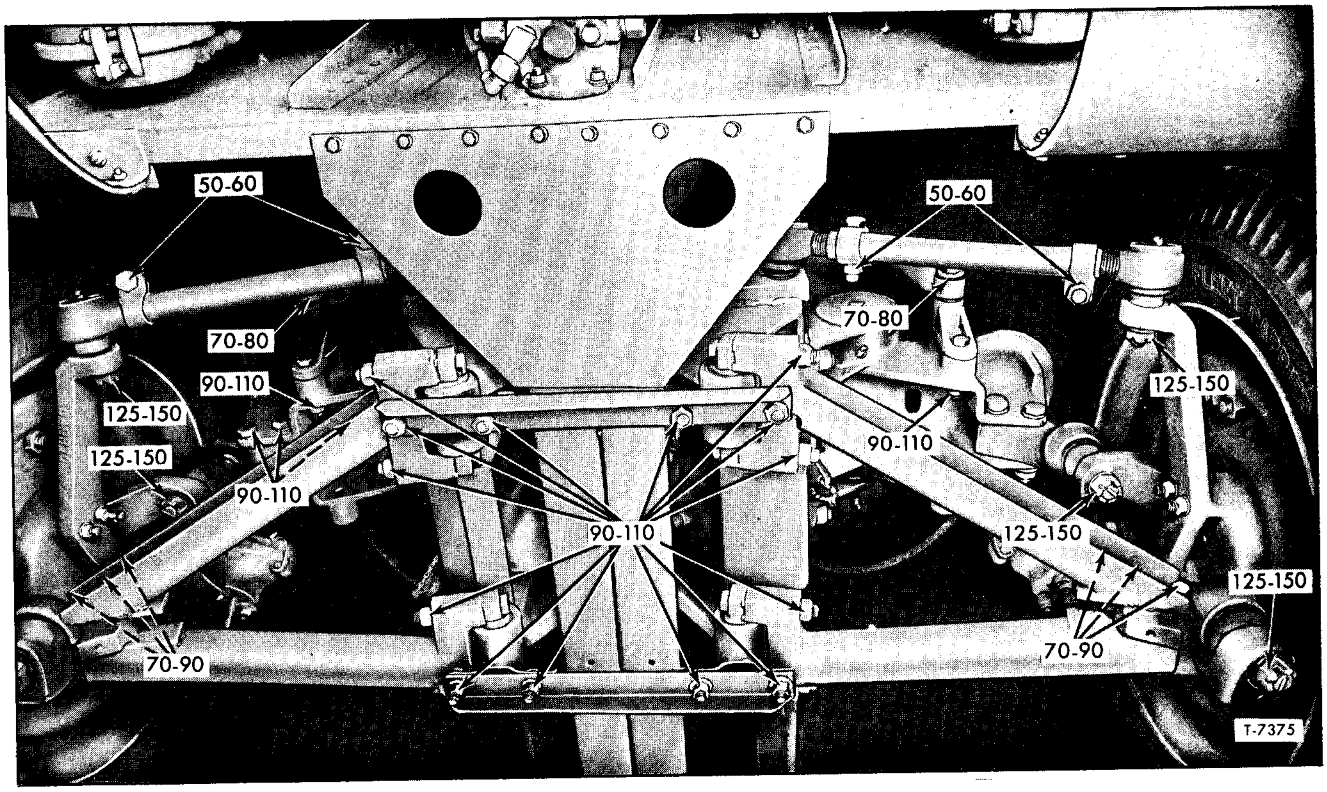


Figure 5—Retractable Axle

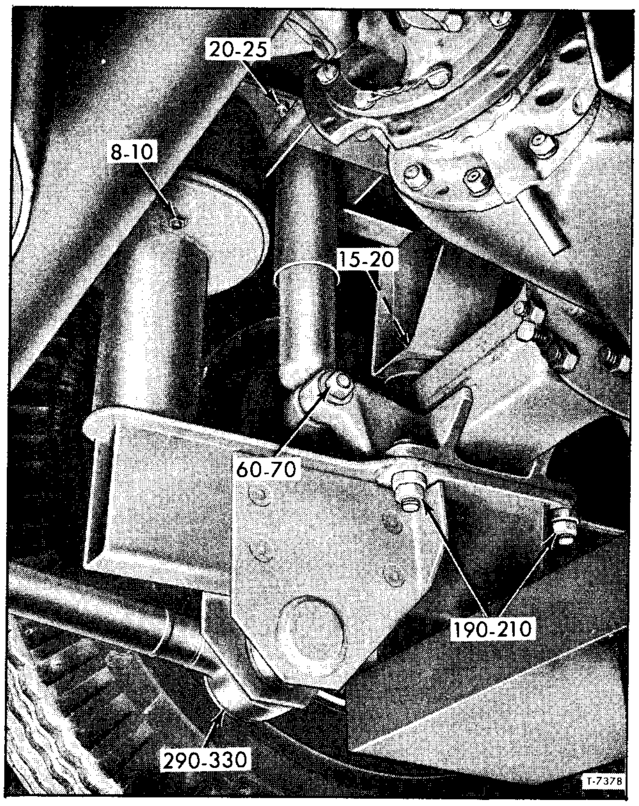


Figure 6—Rear Axle

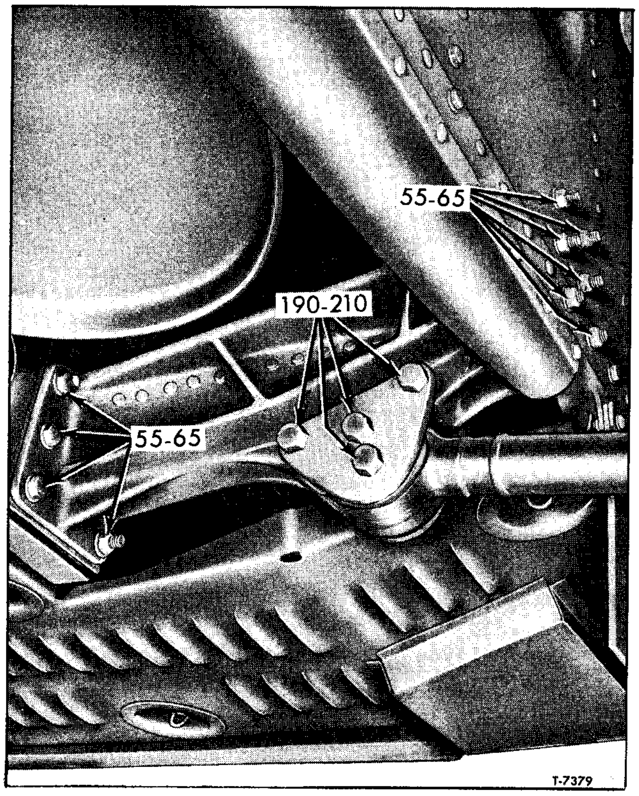


Figure 7—Rear Axle

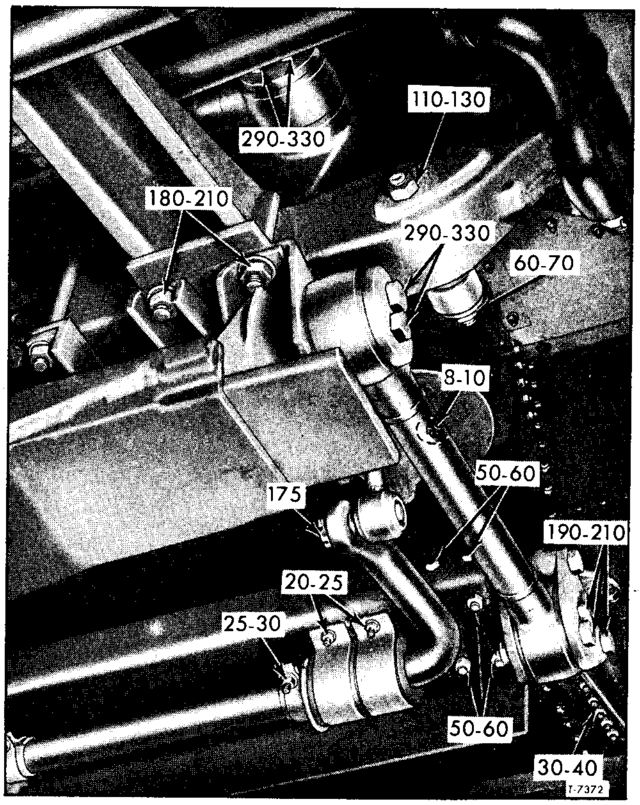


Figure 8—Front Axle and Stabilizer Bar

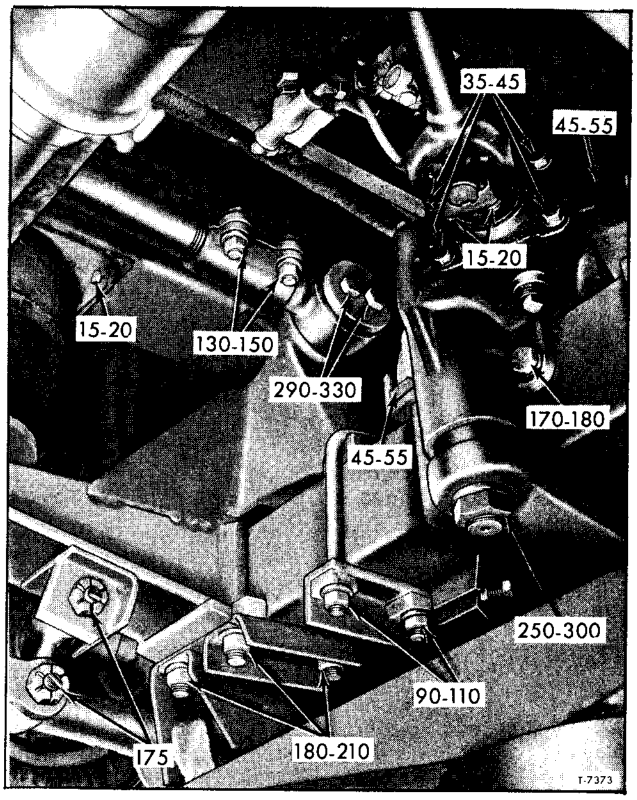


Figure 9—Front Axle

SECTION 16

Steering System

All information on mechanical and power steering in Maintenance Manual X-6814, Section 16, pages 275 through 316 is applicable to models covered by this supplement. Information on PD-4107 applies to PD-4108 and information on on PD-4903 applies to PD-4905.

SECTION 17

Transmissions

All information pertaining to model PD-4903 in Maintenance Manual X-6814, pages 317 through 344 is applicable to models covered by this supplement with the exception of the following:

OIL FILTER

When replacing the disposable-type oil filter on the Spicer 7145VK transmission, install a PF-30 filter and not the PF-7 as designated in X-6814. The filter package is available through normal parts channels under Part No. 6437994.

SHIFT LEVER STUD NUTS

The shift lever stud nuts (14, fig. 21) of Maintenance Manual X-6814, page 336, if removed or replaced should be tightened to 140-160 foot-pounds torque.

SECTION 19

Hubs, Wheels, and Tires

All information in Maintenance Manual X-6814 is applicable to models covered in this supplement. All information on the 4107 model in Manual X-6814 applies to the 4108, and all information on the 4903 model applies to the 4905 model.

AIR FILTER SCREENS MUST BE KEPT CLEAN FOR SATISFACTORY OPERATION OF HEATING SYSTEM.

WHEN MAKING ELECTRICAL CONNECTIONS REFER TO WIRING DIAGRAMS IN "WIRING DIAGRAMS" BOOKLET X-7014A TO MAKE SURE OF PROPER CONNECTIONS.

NEVER OPERATE HEATING SYSTEM WHEN HEATING SYSTEM HAS BEEN DRAINED.

SECTION 26

Heating and Air Conditioning

This group is divided into three sections as shown below:

Subject	Page No.
Heating and Ventilation	117
Air Conditioning - Model PD-4905	121
Air Conditioning - Model PD-4108	199

Heating and Ventilation

Heating and ventilation system information applicable to PD-4108 and PD-4905 coach models remains the same as covered under HEATING AND VENTILATION (SEC. 26) pages 359 through 380 in Maintenance Manual X-6814 except as follows:

DESCRIPTION

Interior of coach is heated by an underfloor hot water, forced air system.

Electrically operated and air operated heating controls function to control the flow of water through the system. Operation of these controls is explained later.

Hot water is supplied by the engine cooling system to a large heater core located in the underfloor heating and ventilation compartment (fig. 1). This compartment also encloses the air filter screen, air conditioning evaporator, and the air circulating blower assemblies. The water booster circulating pump assembly and a water modulation (flow control) valve are located in the heating and air conditioning condenser compartment at left side of coach.

A Grad-U-Stat for controlling coach temperature is located in the right recirculating air duct, underneath passenger seat. A temperature control rheostat for selecting desired temperature within a 10° range (75°F. to 85°F.) is mounted on control panel at left of driver.

The coach heating system is used as a reheat system when the air conditioning system is in operation. Reheat of cooled air is automatically furnished whenever the air conditioning system pulls the coach temperature down below the Grad-U-Stat setting. Thus, whenever air conditioning capacity exceeds the cooling requirement such excess capacity is used to dehumidify the admitted air. The coach temperature remains at the set level by action of the Grad-U-Stat which controls heat admission to the heater core. Operation of the reheat system occurs whenever coach temperature drops below the selected temperature level.

Defroster heater, located behind dash center closure panel, includes a heater core, two blowers, a dampered outlet for warming driver's feet, and a manually adjustable heater water flow control valve. On PD-4905 coach model, an evaporator assembly is mounted on top of the defroster heater.

Outside air for defrosting or ventilation is admitted to heater by impact or is drawn in by heater blowers. Air enters after positioning outside air intake regulator knob in open position. The knob can be positioned to any degree of opening desired.

With control knob in closed position and with front heater blowers operating, coach interior air is then deflected over windshield, driver's window, and entrance door window. Defroster heater motors can be operated at either high or low speed as selected by a switch marked "DEFROST," "HI," and "LO" on switch panel at right of driver.

Warm air from the defroster heater compartment can be directed into the driver's compartment by means of a damper at left side of defroster compartment. Refer to applicable "Heating and Air Conditioning Wiring Diagram" in booklet X-7014A for heating and ventilation circuits.

DEFROSTER-HEATER TEMPERATURE CONTROL VALVE

A manually controlled valve is installed in the defroster heater core supply line (fig. 3). The valve knob, which extends through the heater compartment bulkhead at right of driver, is manually adjusted to control the flow of water through the heater core. Pull up on knob to open the valve and push down on knob to close the valve.

HEATER COIL

The heater coil (fig. 1) located between the blowers and evaporator, is of fin and tube design.

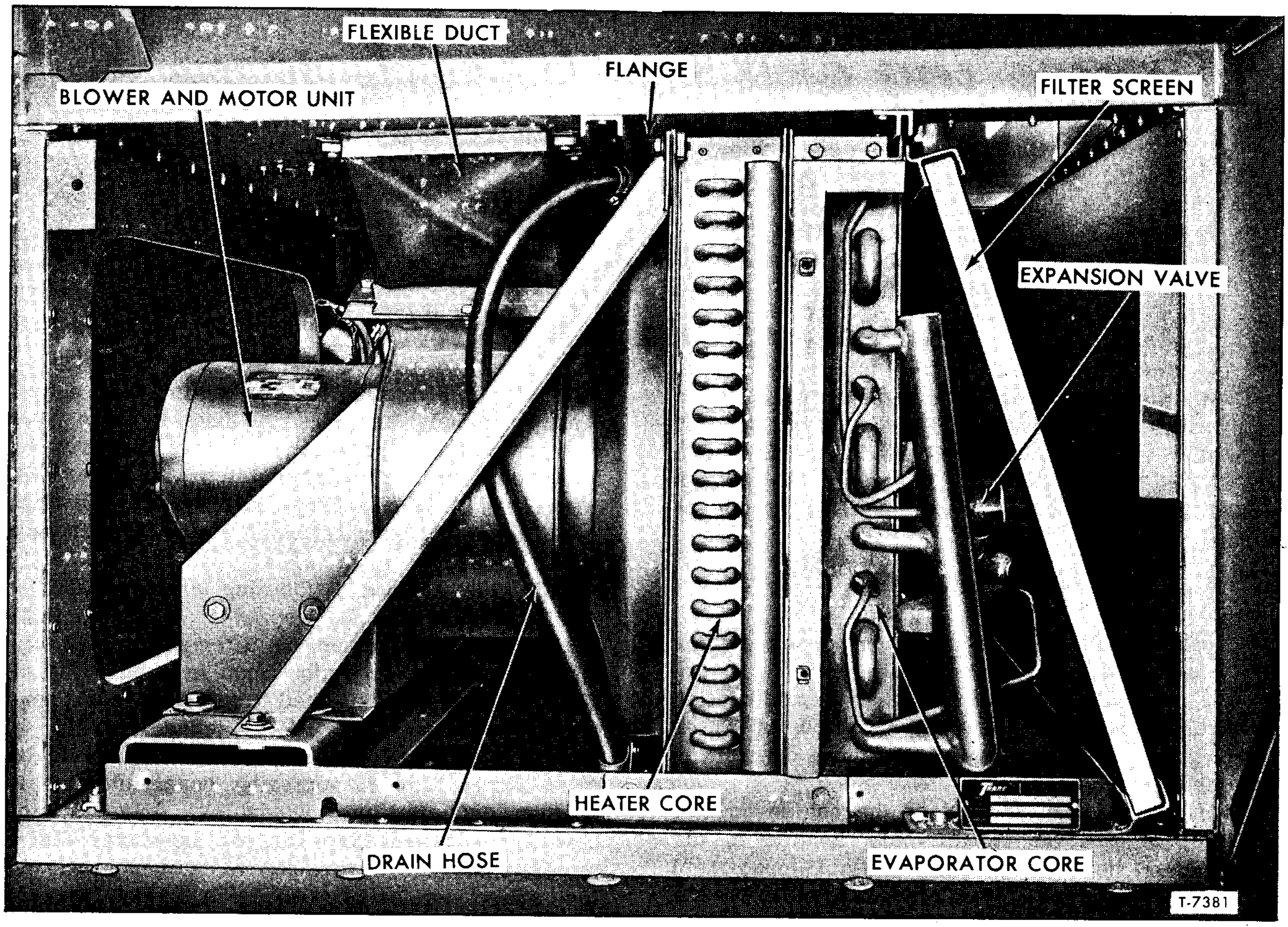


Figure 1—Underfloor Heating and Air Conditioning Compartment (Typical)

REMOVAL OF HEATER COIL

1. Remove access panel from bulkhead inside left front baggage compartment; then drain heating system as explained under "Maintenance" in "HEATING AND VENTILATION" in Maintenance Manual X-6814.

2. On PD-4905 coaches, disconnect batteries, then remove batteries and trays from the compartment.

3. Remove center partition from heating and air conditioning compartment by removing screws and washers.

4. Through access opening in heating and air conditioning condenser compartment, disconnect heater supply and return pipe connection hoses by removing hose clamps. Remove heater coil drain cock.

5. Remove cap screws which attach heater coil to support flanges, channel and shroud; then carefully lift up on heater coil and remove from compartment.

INSTALLATION OF HEATER COIL

1. Position heater coil in heating compartment with supply and return tubes and drain tube extending through bulkhead into heating and air conditioning condenser compartment.

2. From inside heating compartment, position shroud over heater coil, then install cap screws to attach heater coil and shroud to support flanges and channel. Tighten cap screws firmly.

3. Through access opening in heating and air conditioning condenser compartment, connect water supply and return pipe hoses to heater coil with hose clamps. Tighten hose clamp screws securely. Install heater coil drain cock and tighten firmly.

4. Install heating compartment center wooden partition to compartment with screws and washers.

5. On PD-4905 coaches, install battery trays and batteries. Connect all leads to battery terminals.

6. Make sure all hose connections were firmly tightened; then refill the heating system.

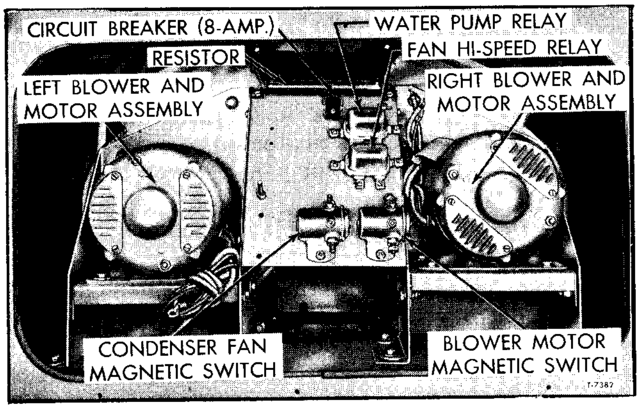

CIRCUIT BREAKER (8-AMP.)
WATER PUMP RELAY
RESISTOR
FAN HI-SPEED RELAY
LEFT BLOWER AND MOTOR ASSEMBLY
RIGHT BLOWER AND MOTOR ASSEMBLY
CONDENSER FAN MAGNETIC SWITCH
BLOWER MOTOR MAGNETIC SWITCH
T-7382

Figure 2—Underfloor Blower and Motor Units Installed (PD-4905 Shown) (Typical)

UNDERFLOOR BLOWER AND MOTOR UNIT

Underfloor blower and motor units consist of the motors, blowers, and blower housing.

Complete units are accessible through forward baggage compartment after removing access plate from bulkhead (fig. 2).

NOTE: A shroud is installed between the heater core and blower housing, and an access panel is installed in front of blower motors and magnetic switches in baggage compartment.

Each unit, supported on mounting brackets and secured in position with mounting bolts, can be removed from compartment as explained under "Blower and Motor Unit Replacement."

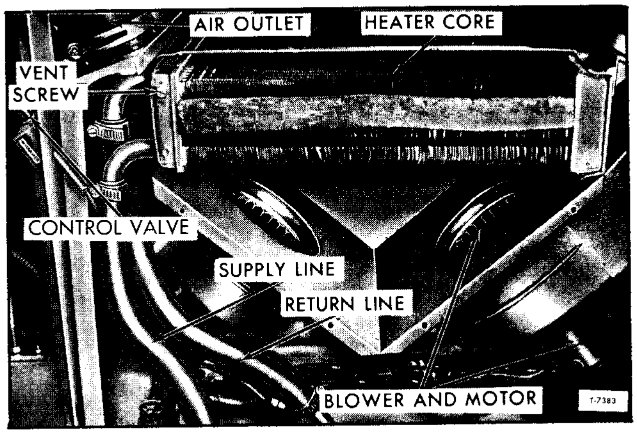


Figure 3—Defroster Heater Assembly Installed with Cover Removed (Typical)

Blower motors operate whenever engine is running and "HEAT-AIR COND." switch is in any position other than "OFF." Motor circuits are controlled by magnetic switches mounted between motor mounts (fig. 2). Servicing of magnetic switches is explained later under "Underfloor Blower Motor Magnetic Switches." Refer to applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for blower motor and switch circuits.

DEFROSTER HEATER

Defroster heater unit, consisting of a heater core and two motors with individual blowers, is

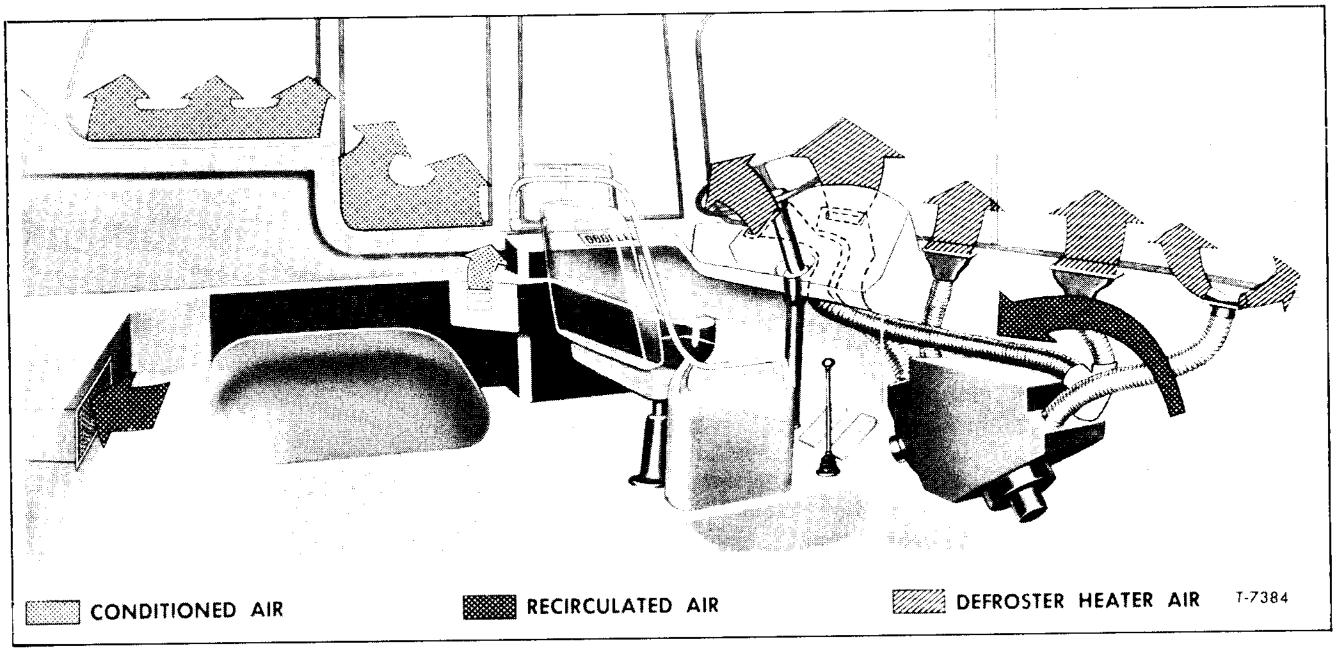


Figure 4—Air Circulation at Front of Coach (Typical)

installed in dash compartment at front of dash center closure panel (fig. 3). Air is distributed by blowers to five defroster air outlets through five flexible air ducts (fig. 4). Air can also be deflected toward driver's feet through a damper controlled outlet. Outlet damper is manually controlled. An adjustable air outlet mounted in left end of instrument panel can be adjusted to direct air toward the driver, or it can be set to direct air to the window at left of driver for defogging.

Slotted head bleeder plug is located at left-upper corner of heater core. Flow of water through heater core is controlled by control valve installed in heater core supply line.

The push-pull type control valve handle is mounted on side of defroster heater compartment at right of driver.

Defroster heater blowers and motors are mounted at underside of heater. Motors require no maintenance, and should operate indefinitely without attention. In the event of failure, motors can be disassembled, brushes replaced, and commutators turned and undercut in accordance with established practice. Whenever motor is disassembled, bearings should be lubricated at assembly. Defroster blowers are controlled by a two-speed "DEFROST" - "HI" and "LO" switch located on right side of instrument panel. Defroster motor circuit is protected by No. 8 circuit breaker on circuit breaker panel, which is located at left of driver.

Heater core, blowers, blower motors, control valve, water pipe connections, and water drain cocks are accessible after removing dash center closure panel which is attached to front end with screws.

Heater core can be removed from unit after draining system, removing heater unit panel, and disconnecting core hoses.

NOTE: On PD-4905 coach model, an evaporator is mounted directly above the heater core.

NOTE: At regular coach inspection intervals, check operation of all heating and ventilation controls. Properly adjusted controls will assure maximum comfort for passengers and driver.

HEATING AND VENTILATION SPECIFICATIONS

UNDERFLOOR BLOWER MOTORS	
GM Part No.	
L.H. Motor	5527642
R.H. Motor	5527643
Make	Delco Products
Rotation (Commutator End)	
L.H. Motor	Counterclockwise
R.H. Motor	Clockwise
R.P.M.	2200
Horsepower	9/16
Volts	27.0
WATER BOOSTER PUMP	
G.M. Part No.	644123
Make	Marine Products
Pump Model No.	12336
Pump Motor	
Model	2902-24
Volts	27.0
Amperes	5.3
R.P.M.	3000
Horsepower	1/8
Rotation (Impeller End)	Counterclockwise
FRONT DEFROSTER HEATER MOTORS	
Number Used	2
G.M. Part No.	664055
Make	Universal
Kysor No.	C-10282-3
Model	52-004
Type	Series
Rotation (Shaft End)	Counterclockwise
Volts	24.0
R.P.M.	2400
Amperes	3.5

WATER MODULATION VALVE	
G.M. Part No.	2236479
Make	Minneapolis Honeywell
Model	VP-511A1057
Starting Pressure	2-4.1 PSI
Pressure Range	8-10 PSI
Fluid Pressure Rating	18 PSIG (Max.)
GRAD-U-STAT	
G.M. Part No.	2486330
Make	Minneapolis Honeywell
Model	TP-928A1015
Temperature Setting	78°F.
AIR PRESSURE REGULATOR VALVE	
Make	Minneapolis Honeywell
G.M. Part No.	2357613
Type	CP-73-26-1
Setting	17 PSI
BLOWER MOTOR MAGNETIC SWITCH	
Make	Delco-Remy
Model	001481
Rated Voltage	24
Current Consumption	
Both Windings	
Amps	0.83-0.89
Volts	24
HEATING CONTROL RHEOSTAT	
Make	Ohmite
G.M. Part No.	2486361
Maximum Amperes	
At 0.5 Ohms	10.0
At 10,000 Ohms	0.070

Air Conditioning

(MODEL PD-4905)

Air conditioning information in this section, which is complete and not supplementary, applies to all PD-4905 coach models, equipped with the Model "G" refrigerant compressor.

This group, covering operation, maintenance, and repair information on GM Coach Air Conditioning system, is divided into major sections as shown below:

Subject	Page No.
General Description	121
System Operation	124
System Maintenance	130
System Services and Tests	177
Troubleshooting	188
Lubrication and Inspection	194
Equipment and Materials	195
Specifications	197

Information pertaining to a specific control, service, or test, will be found by using the quick page reference index shown at beginning of each respective section.

NOTE: Air conditioning controls and units, such as temperature control Grad-U-Stat, underfloor blowers, heater core unit, air filter screen, and water pump, are also used in conjunction with the coach heating system. These controls and units which are common to both systems are covered in "HEATING AND VENTILATION" section of this group in this supplement or in Manual X-6814.

General Description

The GM coach air conditioning system is designed to provide passenger comfort by cooling, dehumidifying, and filtering the air which is force-circulated within the coach. The entire heating system is utilized to control or temper the air which is cooled by the air conditioning system. This tempering or temperature-raising process provides the necessary "reheat" phase of the air conditioning system.

The air conditioning system units are accessible through access doors at left and right side of coach and through access openings in forward baggage compartment bulkhead. System units are shown schematically in figures 1 and 2.

The air conditioning system is comprised of the following units and controls. Refer to figures 1 and 2.

CONDENSING SYSTEM

The condensing system consists of:

1. A Three-Cylinder Reciprocating-Type refrigerant compressor, shaft-driven from accessory drive take-off on coach engine. Compressor is mounted below floor forward of engine bulkhead and is accessible after opening door on left side of coach directly behind rear wheels.
2. A Fin and Tube-Type Condenser Coil with a six-blade cooling fan driven by an electric motor.
3. A Liquid Refrigerant Receiver mounted within the condenser compartment.

COOLING UNITS

The cooling units consist of:

1. An evaporator coil of fin and tube-type construction is mounted in underfloor heating and cooling compartment and is accessible through the forward compartment door at right side of coach. An additional evaporator coil of fin and tube-type construction is mounted above the heater core at front of coach. Coil is accessible after removing the front defroster heater access panel.
2. A refrigerant Expansion Valve of multi-outlet-type is mounted to the evaporator coil and

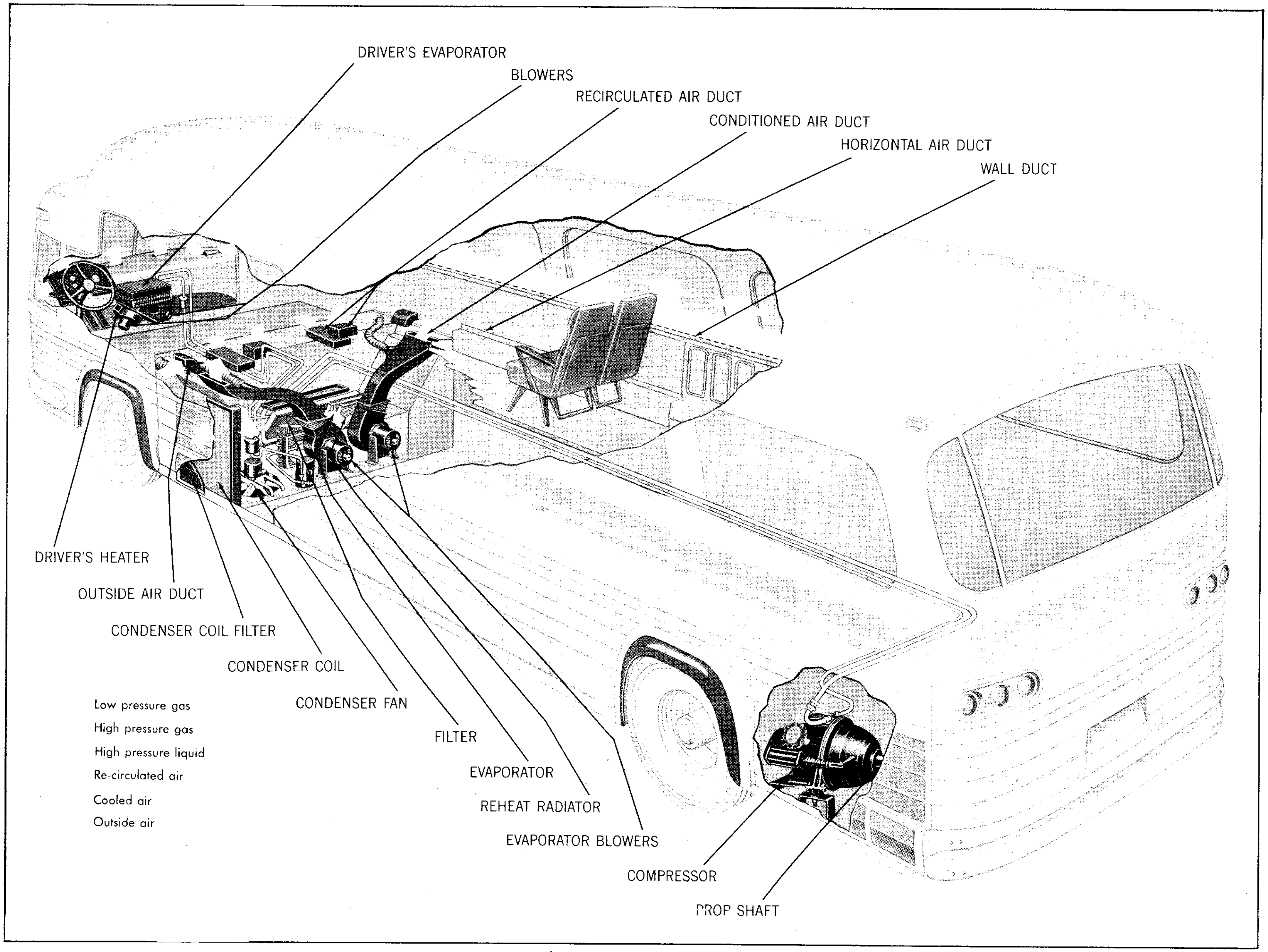


Figure 1—Refrigerant Lines and Air Flow (Typical)

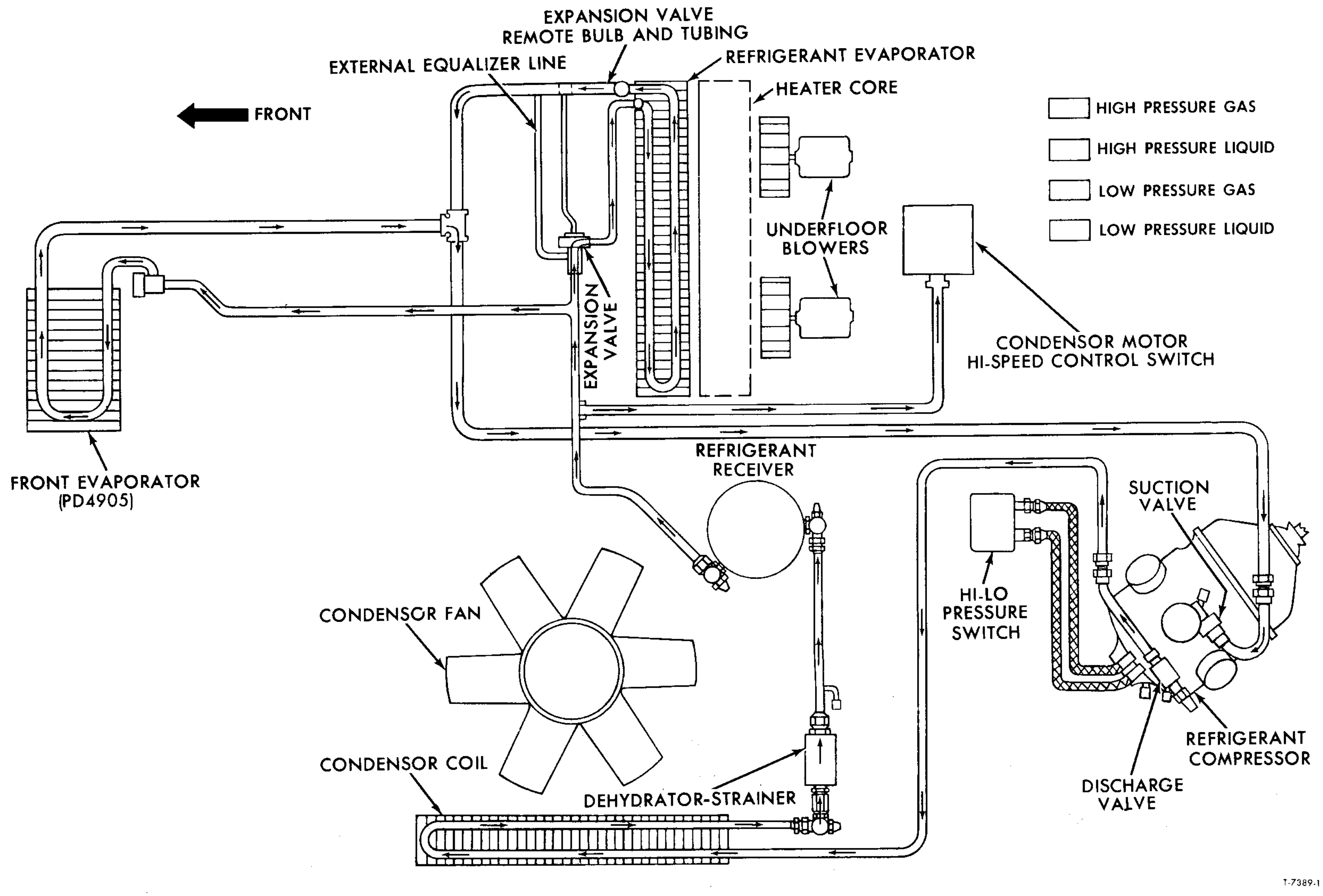


Figure 2—Schematic of Refrigerant Controls and Lines Showing High and Low Pressure (Typical)

refrigerant liquid line. Expansion valve is accessible through compartment at right side of coach. The evaporator coil at front of coach is also equipped with an expansion valve which is accessible after removing the front heater panel.

3. A Dehydrator-Strainer of disposable-type is mounted in liquid line at rear of condenser compartment and is accessible through access opening in forward baggage compartment.

AIR CIRCULATION SYSTEM

The air circulation system consists of the same air intakes, filters, blowers and air distribution ducts used in the coach heating system.

SYSTEM CONTROL UNITS

The air conditioning system controls consist of "HEAT-AIR COND." switch on panel at left of driver, an electrically-energized air-operated friction clutch mounted on drive end of refrigerant compressor, and several automatic controls such as pressure switches, relays, and an air supply solenoid valve. These controls are described later under "System Operation."

DRIVER'S OPERATING INSTRUCTIONS

Driver's control of air conditioning is accomplished by the positioning of switch marked "HEAT-AIR COND." mounted on control panel at left of driver.

TO OPERATE COOLING SYSTEM

NOTE: Defroster heater water control valve must be fully closed for maximum cooling.

CAUTION

Do not engage air conditioning unless engine is at idle and vehicle speed is less than 25 miles-per-hour.

With engine running at idle speed and vehicle speed at less than 25-miles-per-hour, push "HEAT-AIR COND." switch to "AIR COND." position. With switch in this position, the underfloor blower high speed circuit is energized and blowers run continuously at high speed. Except for this action, operation of the air conditioning system is completely automatic.

Temperature thermostat setting can be regulated within a 10-degree range, by use of dial control marked "TEMP. RANGE" on control panel at left of driver.

A short delay may occur before air conditioning system starts to operate. Two likely reasons for this condition are:

1. Engine oil pressure too high at normal idle: Engine oil pressure switch contacts will not close to complete circuit to air conditioning controls if oil pressure exceeds 25 psi. Engagement will occur as soon as oil warms up and pressure drops below 25 psi.

2. Pressure in coach air system is low: A minimum of 65 psi air pressure is required to operate compressor clutch controls. Build up required air pressure.

NOTE: When operating system for any extended period of time while the vehicle is parked, the engine rpm should be increased to fast idle by applying the parking brake, then placing "FAST IDLE" switch on control panel at left of driver in "FAST IDLE" position.

NOTE: The "A/C STOP" tell-tale, located on tell-tale panel in front of driver, will illuminate whenever the refrigerant "HI-LO" pressure switch contacts are open and compressor clutch is disengaged. If light stays on and coach temperature rises, report condition to service personnel.

IMPORTANT: KEEP WINDOWS CLOSED AND DO NOT LEAVE ENTRANCE DOOR OPEN ANY LONGER THAN NECESSARY.

System Operation

Contents of this section are listed in Index below:

Subject	Page No.
General Operation	125
Fundamental Principles of Refrigeration	126
Refrigerant	126
Refrigerant Circulation	127
Air Circulation	128
Operation of Electrical Control Units	128

GENERAL OPERATION

Some controls and units used with the air conditioning system are common to the coach heating system. These controls and units are: Control switch, marked "HEAT," "OFF," and "AIR COND." defroster control valve, underfloor air blowers, and air filter screen, heater core, and air intake and distribution ducts and the Grad-U-Stat.

The heating and cooling systems operate independently of each other, except under certain conditions of cooling system operation when there is an overlapping operation of both systems as explained previously.

The driver can select temperature setting within a 10-degree range by using the "TEMP. RANGE" control knob on control panel.

When the "HEAT-AIR COND." switch on panel at left of driver is placed in "AIR COND." position, the air conditioning system functions as follows:

NOTE: Refer to applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections. Air conditioning system is schematically illustrated in figure 3.

1. With engine running and "HEAT-AIR COND." control switch in "AIR-COND." position, underfloor blower high speed circuit is energized and blower motors run continuously at high speed.

2. The engine must be running at idle speed, and the air pressure in coach air system must be more than 65 psi to close low air pressure switch before circuit through the refrigerant "HI-LO" pressure switch is completed to operating coil of air conditioning clutch relay, air conditioning clutch solenoid valve, and oil pressure switch. Solenoid valve, oil pressure switch and relay are located in the compressor compartment.

3. Air conditioning clutch control relay is a lock-in type unit; that is, after operating coil is energized and contacts close, contacts will remain closed as long as the circuit through the contacts

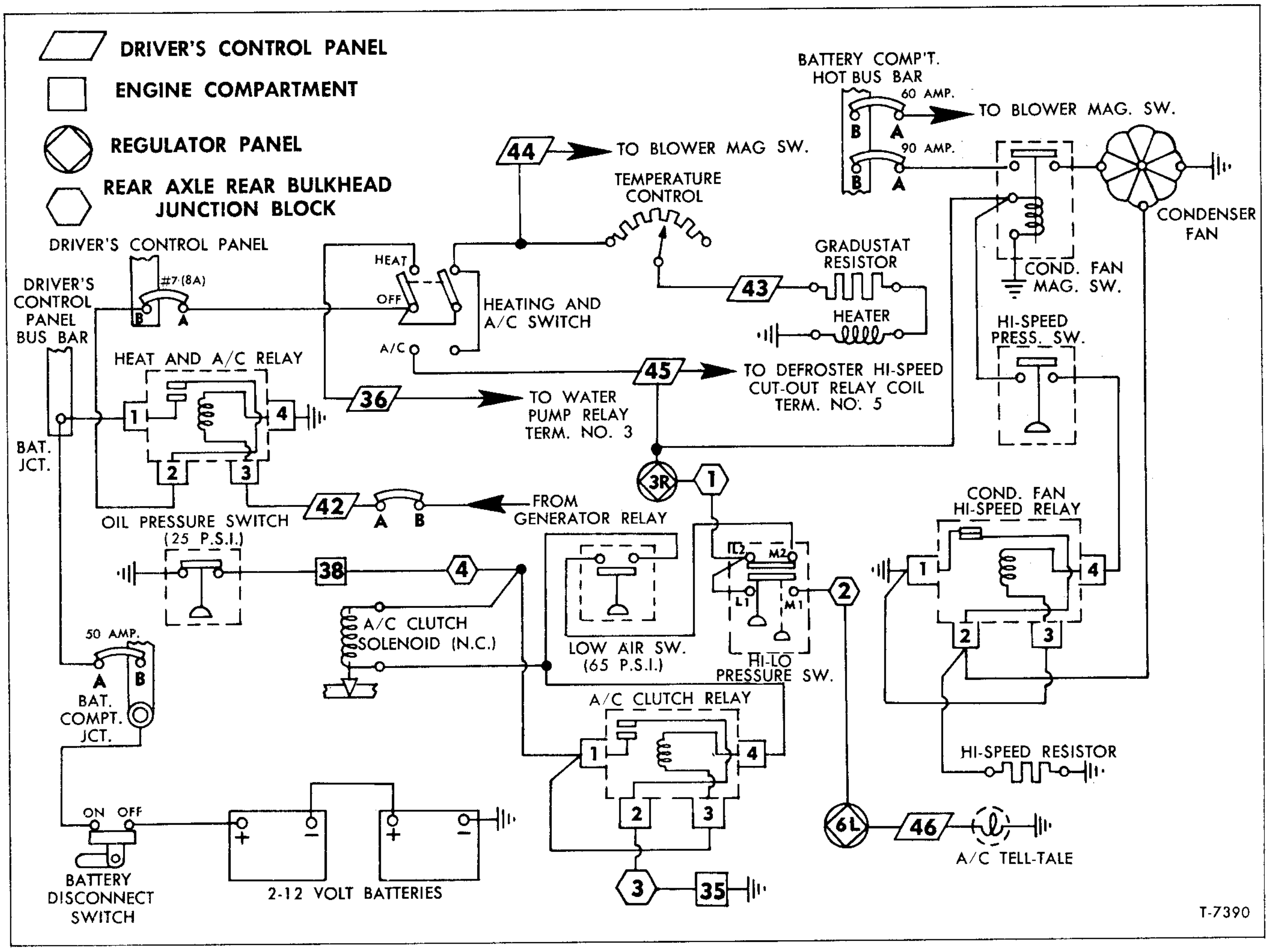


Figure 3—Schematic Diagram of Model PD-4905 Air Conditioning System

is not broken. Each of the following conditions can break the circuit and cause relay contacts to open.

a. Too high or low refrigerant pressure.

b. Coach engine stops running.

c. "HEAT-AIR COND." switch not in "AIR COND." position.

d. Low air pressure (below 65 psi).

e. "HI-LO" pressure switch faulty.

f. Air cooled generating system fails.

g. Air Conditioning condenser fan drive motor not operating properly.

NOTE: For information pertaining to relays used in conjunction with the Air Conditioning system, refer to "Relays" in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) of this supplement.

FUNDAMENTAL PRINCIPLES OF REFRIGERATION

The principle of operation of the refrigeration system is based on a few simple laws of physics which are stated informally as follows:

1. Temperature is a measurement of the intensity of heat.

2. Heat is a form of energy. When heat is added to a substance, it usually is noticed by an increase in temperature. For example, in order to raise the temperature of water from 35°F. to 100°F., it is necessary to add a certain amount of heat.

3. When an object cools, it does not absorb cold, but rather it loses heat to a colder object or substance nearby. When a bottle containing warm liquid is placed on a cake of ice, the ice will melt and the bottle and its contents will become cool. Heat from the bottle and its contents is lost to the ice.

4. When a liquid boils, turning to vapor, it absorbs a great amount of heat. For instance, water boiling on a stove is absorbing a great amount of heat from the burner as it is changing to the vapor commonly called steam. Boiling is a rapid form of evaporation.

When a liquid boils, it absorbs heat without changing temperature. For example, when heat is added to water at sea level, as when heating on a stove, the temperature of the water will rise until it reaches 212°F. If the water remains on the hot stove, it will boil, but the temperature will remain at 212°F. The heat being absorbed by the water is changing it to steam rather than raising the temperature.

Refrigerant-22 used in air conditioning system boils at 41.7°F. below zero at atmospheric pressure. Thus, if it were exposed to the air at normal room temperature, it would absorb heat from surrounding air and boil, immediately changing to a vapor.

5. When heat is removed from water vapor, it will condense back into a liquid. For example, the steam caused by boiling water on a stove will condense into water on the underside of the cover. This is due to the fact that the cover is not as hot as the steam. The cover, therefore, takes heat from the steam, condensing it back to water.

6. The temperature at which substances will boil or condense is affected by pressure. If the pressure is increased, the liquid will not boil until a higher temperature is reached. Thus, we can prevent refrigerant from boiling if it is kept under high pressure. If this high pressure is suddenly released, refrigerant will immediately boil. This has been demonstrated on modern vehicles with pressure cooling systems.

When the pressure of a vapor is increased, the temperature at which it will condense is also raised. Steam at below 212°F., if heat is removed from it, but it can be made to condense at higher temperature by increasing the pressure.

7. Compressing a vapor increases its temperature. For example, when pumping air into a tire with hand pump, the pump will become warm due to the heating of the air as it is compressed.

8. When a liquid is heated until it is converted to a gas, then this gas is heated additionally without changing pressure, the gas is said to be superheated. For instance, in the evaporator refrigerant absorbs heat and boils at a constant temperature and pressure until it has been completely vaporized, and it continues to absorb heat from the warm air passing over the evaporator without any increase in pressure. Since this heat is no longer being used to convert the refrigerant from a liquid to a gas, it will now cause the temperature of the refrigerant gas to rise. The refrigerant is then superheated.

REFRIGERANT

The refrigerants used are commonly known by their trade name of Freon-22, Isotron-22, or Genetron-22. Regardless of brand, refrigerant-22 must be used. The chemical name of refrigerant-22 is monochlorodifluoromethane ($CHClF_2$).

REFRIGERANT CHARACTERISTICS

Refrigerant exists as a gas at atmospheric pressure and must be held under pressure to remain liquid. At 75°F., it will exist as a liquid under a pressure of about 133 pounds per square inch.

Refrigerant has very little odor, but in large concentrations a distinct odor may be detected. It is colorless in both its liquid and gaseous states.

Refrigerant is nonpoisonous, nonflammable, and nonexplosive. It is noncorrosive to metals.

Goggles should be worn whenever there is the slightest possibility of refrigerant coming in contact with the face or eyes, because refrigerant evaporates and cools so rapidly it will cause an injury similar to frostbite.

PROCUREMENT

Refrigerant is shipped and stored in metal drums.

Be sure to follow the instructions under "Charging the System" explained later.

NOTE: Approximately 23 lbs. of refrigerant is required in system.

PRECAUTIONS IN HANDLING REFRIGERANT

1. Do not leave drum of refrigerant uncapped.
2. Do not subject drum to high temperature.
3. Do not weld or steam clean on or near system.
4. Do not fill drum completely.
5. Do not discharge vapor into area where flame is exposed.
6. Do not expose eyes to liquid.

Some refrigerant drums are shipped with a heavy metal screw cap. The purpose of the cap is to protect the valve and safety plug from damage. It is good practice to replace the cap after each use of the drum for the same reason. If the drum is exposed to the radiant heat from the sun, the resultant increase in pressure may cause the safety plug to release or the drum to burst.

For the same reason, the refrigerant drum should never be subjected to excessive temperature when charging a system.

Welding or steam cleaning on or near any of the refrigerant lines or components of the air conditioning system could build up dangerous and damaging pressures in the system.

If a small drum is ever filled from a large one, never fill the drum completely. Space should always be allowed above the liquid for expansion. Weighing drums before and during the transfer will determine fullness of drums.

Discharging small quantities of refrigerant into a room can usually be done safely as the vapor would produce no ill effects. However, this should not be done if the area contains a flame-producing device such as a gas heater. While refrigerant normally is nonpoisonous, heavy concentrations of it in contact with a live flame will produce a poisonous gas. The same gas will attack all bright metal surfaces. When large quantities of refrigerant are discharged, the area must be well ventilated since refrigerant will displace air.

DO NOT EXPOSE EYES TO REFRIGERANT

One of the most important precautions is protection of the eyes when handling refrigerant. Any liquid refrigerant which may accidentally escape is approximately 41°F. below zero. If any refrigerant comes in contact with the eyes, serious injury could result. Always wear goggles to protect the eyes when handling refrigerant.

If refrigerant should come in contact with the eyes:

1. DO NOT rub the eyes. Splash the eyes with cold water to gradually get the temperature above the freezing point.
2. Apply a protective film of an antiseptic oil over the eye-ball to reduce the possibility of infection.
3. Consult a doctor or an eye specialist immediately.

Should liquid refrigerant come in contact with the skin, the injury should be treated the same as though the skin had been frostbitten or frozen.

REFRIGERANT CIRCULATION

Refrigerant control units and piping is illustrated in figure 2. A complete cycle of the refrigerating system is as follows:

1. Refrigerant in its gaseous state is drawn into the compressor where it is compressed and discharged into the condenser.
2. As the heated gas circulates through the condenser coils, it is cooled by air being forced through the condenser by an electrically driven fan. The combined effects of decreased temperature and increased pressure cause the gas to condense (liquify).
3. The liquid refrigerant is then forced from the condenser into the liquid receiver.
4. By its own pressure, liquid refrigerant is forced from liquid receiver through the dehydrator-strainer then through the expansion valve into the evaporator.

NOTE: An additional evaporator and expansion valve is mounted in driver's defroster heater compartment at front of coach. The front evaporator is mounted directly above the front heater core.

5. In the evaporator, where the pressure is reduced, the liquid refrigerant evaporates, or changes into a gaseous state. As the liquid evaporates, heat is absorbed from the air passing through the evaporator coils, thus the air is cooled.
6. Flow of refrigerant into the evaporator is regulated by the expansion valve. The expansion valve is actually a pressure reducing valve which serves two purposes:

a. It maintains pressure on the liquid line.
b. It admits only the required amount of

liquid refrigerant into the evaporator, this requirement being determined by the temperature of the gaseous refrigerant at the evaporator outlet.

7. The low pressure refrigerant gas then passes from the evaporator back through the suction line to the compressor thus completing the cycle.

NOTE: Gauges for checking pressures in the refrigerant system can usually be obtained from a local refrigeration service and supply dealer.

AIR CIRCULATION

With "HEAT-AIR COND." switch on control panel at left of driver in "AIR COND." position and with a minimum of 65 psi air pressure to compressor clutch control, and engine oil pressure below 25 psi, the compressor will operate and underfloor blowers will run.

The blowers draw outside air into heating and cooling compartment through perforated openings at each side of coach just below windows. The outside air is blended with recirculated air which enters same heating and cooling compartment through screened openings in floor, one each side of aisle under seats and two inch step riser. This blended air is then drawn by blowers through a screen where it is filtered, through evaporator coil where it is cooled and dehumidified, and then through the heater core unit where the temperature is raised to comfort level to extent determined by the control Grad-U-Stat unit. Tempered air then flows into coach interior through vertical duct vents located below the coach windows.

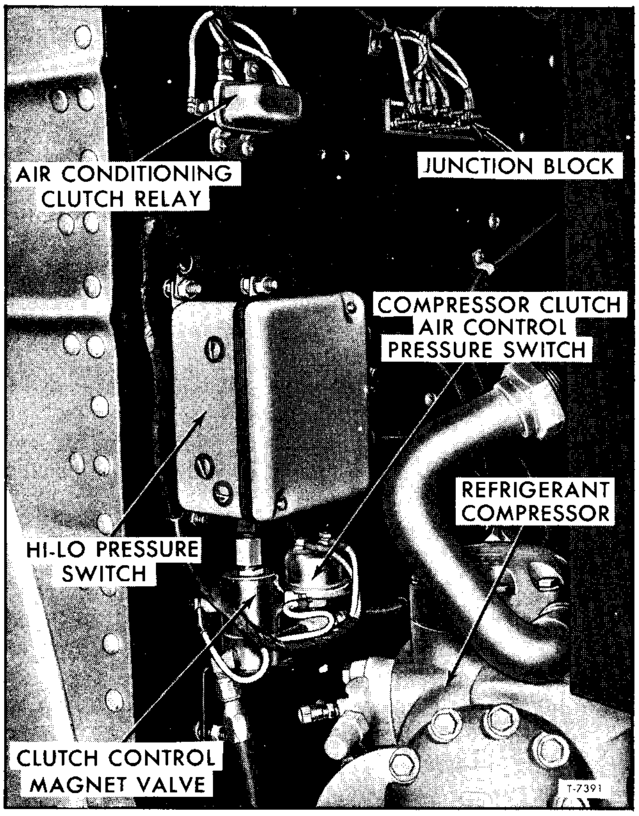

AIR CONDITIONING CLUTCH RELAY
JUNCTION BLOCK
COMPRESSOR CLUTCH AIR CONTROL PRESSURE SWITCH
REFRIGERANT COMPRESSOR
HI-LO PRESSURE SWITCH
CLUTCH CONTROL MAGNET VALVE
T-7391

Figure 4—Air Conditioning Control Units

OPERATION OF ELECTRICAL CONTROL UNITS

Refer to "HEATING AND VENTILATION" section in this supplement or in Maintenance Manual X-6814 for operating information on controls such as: Grad-U-Stat, "TEMP. RANGE" control knob, air pressure regulating valve, blower motors, blower motor relay or magnetic switch, water valve, and heating system water pump.

"HEAT-AIR COND." CONTROL SWITCH

Control switch marked "HEAT-OFF-AIR COND." on control panel at left of driver is a three-position toggle type switch.

With switch in "AIR COND." position, the circuit to underfloor blowers and to front air conditioning unit blowers is energized causing motors to operate, and circuit is completed through the "HI-LO" refrigerant pressure switch. Circuits are shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

RELAYS

Several relays are used to control or protect the air conditioning system on these coaches. The heat and air conditioning relay is mounted on the driver's control and apparatus panel at left of driver as shown in figure 4 in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) in this supplement. The condenser fan "HI-SPEED" relay and resistor is mounted on the ventilation compartment apparatus panel (fig. 11) in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) in this supplement. The air conditioning clutch control relay, clutch control air pressure switch, compressor drive clutch air solenoid valve and the refrigerant "HI-LO" pressure switch are mounted on bulkhead in refrigerant compressor compartment as shown in figure 4.

Refer to "Relays" in "WIRING AND MISCELLANEOUS ELECTRICAL" in "ELECTRICAL SYSTEM (SEC. 7) for internal operation of these relays.

Following is a brief description of the function of each relay.

Heat and Air Conditioning Relay (1116964)

This relay serves to control the feed circuit to the "HEAT-AIR COND." switch.

Relay operating coil terminal No. 3 is fed from generator relay when engine is running and generator is charging.

When engine is started, current from generator "R" terminal is supplied through operating coil of generator control relay causing normally open contacts to close, thus completing the circuit from battery to operating coil of the heat and air conditioning relay through number 6 circuit breaker on regulator and apparatus panel. With windings energized, contacts will close to complete circuit from battery to "HEAT-AIR COND," switch through No. 7 circuit breaker on driver's control and apparatus panel.

Relay serves to break the feed circuit to the "HEAT-AIR COND." switch in the event engine stops running or air cooled generating system fails.

Air Conditioning Clutch Control Relay (1116964)

This relay serves to break electrical circuit to compressor drive clutch air solenoid valve, causing valve to open, thus admitting air pressure to clutch.

Relay is a lock-in type unit; that is, after operating coil winding is energized and contacts close, contacts will remain closed as long as the circuit through the contacts is not broken. The lock-in feature of this relay maintains circuit to air conditioning clutch solenoid valve after the oil pressure switch opens. Any one of the following conditions can break the circuit and cause relay contacts to open.

1. Excessively high or low refrigerant pressure.
2. Engine stops running.
3. Low air pressure (below 65 psi).
4. "HEAT-AIR COND." switch not in "AIR COND." position.
5. Air cooled generating system fails.

Condenser Fan "Hi-Speed" Relay (1115860)

This relay, mounted on the ventilation compartment apparatus panel (fig. 11) in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) serves to control the speed of the condenser fan.

When "HEAT-AIR COND." switch is placed in "AIR COND." position, the condenser fan magnetic switch operating coil is energized, causing magnetic switch contacts to close. Current from the battery compartment 90-AMP circuit breaker will then flow through the magnetic switch contact points to energize the condenser fan motor. Current from the condenser fan motor "F" terminal to condenser fan "HI-SPEED" relay terminal No. 2. Current will then flow through normally closed contacts and out terminal No. 1 thus causing the fan to operate at low speed.

As temperature increases, the "HI-SPEED" pressure switch contacts will close to complete circuit through operating coil of the "HI-SPEED" relay causing the normally closed contacts to open. Current from the condenser fan motor "F" terminal will then flow to ground through the "HI-SPEED" resistor causing the fan to operate at high speed.

ENGINE OIL PRESSURE SAFETY SWITCH

Engine oil pressure safety switch is mounted in manifold on engine bulkhead as shown in figure 5 in ENGINE (SEC. 8) in Maintenance Manual X-6814.

With engine running and oil pressure at 25 psi or more, contacts of safety switch are opened. Purpose of switch is to prevent engagement of air conditioning compressor drive clutch if switch is placed in "AIR COND." position with warm engine running above 600 rpm.

CLUTCH CONTROL AIR PRESSURE SWITCH

Air pressure switch is mounted on bulkhead in air conditioning compressor compartment (fig. 4). Purpose of switch is to prevent compressor drive clutch slippage which could be caused by insufficient operating air pressure.

Contacts of switch close when air pressure in coach air system exceeds 65 psi. Switch completes circuit from "AIR COND." terminal on "HEAT-AIR COND." switch on control panel at left of driver, through the refrigerant "HI-LO" pressure switch, to low air pressure switch, then to the air conditioning clutch control relay as shown on "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A.

COMPRESSOR DRIVE CLUTCH AIR SOLENOID VALVE

Compressor drive clutch solenoid valve is mounted on bulkhead in refrigerant compressor compartment as shown in figure 4.

The electrically-operated solenoid valve controls the flow of air pressure for operation of compressor drive clutch. Circuit to valve is controlled by the air conditioning clutch control relay mounted on bulkhead in refrigerant compressor compartment at left rear of coach.

With valve coil energized, air pressure is permitted to pass through valve and flexible line to engage the compressor clutch mechanism. When valve is de-energized by action of the relay, air pressure is exhausted from clutch drive mechanism to disengage clutch.

REFRIGERANT "HI-LO" PRESSURE SWITCH

Definite high and low refrigerant pressures are established at which the system will operate efficiently and safely. "HI-LO" pressure cutout switch is provided to prevent operation of system when pressures exceed these limits. The switch is located in compressor compartment (fig. 4). Switch is connected to high and low refrigerant pressure fittings on the compressor. Current from "HEAT-AIR COND." switch is routed through the "HI-LO" pressure switch. Whenever the high or low refrigerant pressure exceeds limits, the switch interrupts compressor clutch controls to stop compressor. When this occurs, another set of contacts within control relay close to complete circuit from "HEAT-AIR COND." control switch to the "A/C STOP" tell-tale on gauge and tell-tale panel in front of driver. Tell-tale, when illuminated, indicates that compressor is not operating. When refrigerant pressures normalize to the switch cut-in point, compressor clutch control circuit is again completed and the compressor becomes operative.

System Maintenance

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REFRIGERANT HI-LO PRESSURE SWITCH

The "HI-LO" pressure switch (fig. 5) is a dual pressure control switch connected in series with the air conditioning control circuit, and actuated by the high side and low side refrigerant pressures. The control unit consists basically of two bellows, both of which are connected through spring-loaded toggle linkage to a set of contact points, all enclosed within a dust-proof case.

Low pressure cut-out and cut-in points are adjustable; high pressure cut-out point is adjustable but the differential on the high pressure side of switch is fixed and nonadjustable. Access plugs are provided in side of case to permit making adjustments with a straight screwdriver.

All four wire terminals, L1, L2, M1, and M2 are used on this installation. Either of the two bellows assemblies and the contact assembly are replaceable. When connecting lines to either bellows, it is extremely important to use a wrench on hex portion of bellows element while tightening hose fitting to prevent damaging bellows.

The "HI-LO" pressure cut-out switch is properly set at the factory and should not normally require adjustment in the field. However, in the event of improper operation, switch operation can be tested and adjusted, if necessary, as follows:

LOW PRESSURE TEST AND ADJUSTMENT

Low pressure cut-out is an extremely important adjustment. System will not function satisfactorily and possible damage to compressor may result if switch points fail to open near the designated pressure. In making the following test, an accurate compound (pressure and vacuum) gauge should be used.

NOTE: A gauge set for checking refrigerant pressures can usually be obtained from local refrigerant sales and service dealer.

1. Remove cap from suction valve test gauge fitting, then connect gauge at low pressure line to fitting. Have an assistant close suction valve on top side of compressor by turning valve stem in (clockwise) until valve seats.

2. Start coach engine and operate compressor, then observe pressure reading on gauge at the instant compressor clutch becomes disengaged and compressor stops. Switch points should open to disengage clutch at 10 psi gauge pressure.

3. Next allow pressure to build up until compressor clutch becomes engaged. Pressure reading on gauge when switch points close and complete circuit to compressor clutch drive should be 25 psi.

4. If switch points do not open and close at gauge readings specified in Steps 2 and 3, adjust as follows:

a. Remove switch cover, and remove adjusting screw access plugs from side of case.

b. If only the cut-out point requires adjustment, turn adjusting screw (4). Indicator is calibrated in increments of 5 psi.

c. If the cut-in point requires adjustment, turn adjusting screw (3), which changes the cut-in and cut-out points an equal amount, then re-adjust cut-out point by turning screw (4).

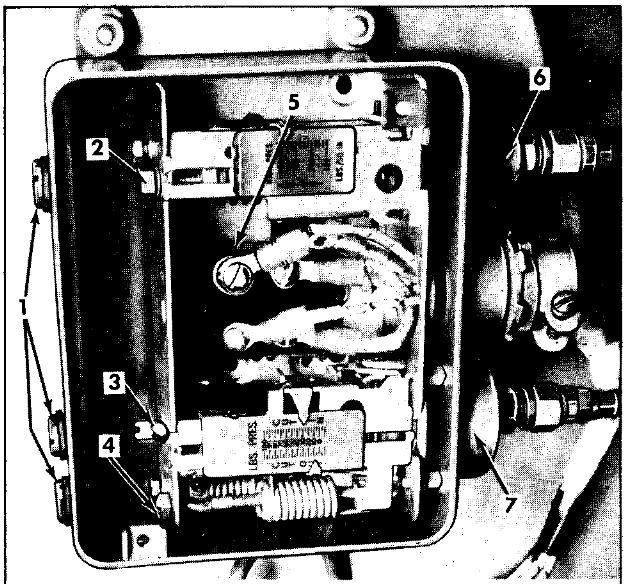
d. After adjusting, recheck operation of unit as described above, then open suction valve at top of compressor.

HIGH PRESSURE TEST AND ADJUSTMENT

The high pressure side of the switch should open the points and disengage the compressor clutch at 425 psi gauge discharge pressure, and permit the points to close when pressure drops to 375 psi. The point at which the switch cuts out is adjustable, but the cut-in point is not adjustable. Test switch and adjust if necessary as follows, using an accurate high pressure gauge:

1. Remove cap from discharge valve test gauge fitting, then connect gauge set high pressure line to fitting.

2. With both the suction and discharge valves in operating position (cracked 1/2 to 1 turn away from backseated position), operate compressor. Stop condenser fan or block coil while system is operating and observe pressure reading on gauge the instant the compressor stops. If gauge reading when compressor stops is more or less than 425 psi, adjust by turning adjusting screw (2).



1 Access Plugs
2 High Pressure Cut-Out Adjustment
3 Low Pressure Range Adjustment
4 Low Pressure Cut-Out Adjustment
5 Contact Assembly
6 High Pressure Bellows
7 Low Pressure Bellows

T-2283

Figure 5—Refrigerant Hi-Lo Pressure Switch

> CAUTION: If high pressure switch fails to disengage compressor clutch when pressure reaches 435 psi, stop compressor, as pressures in excess of this may damage other units.

3. After turning adjusting screw (2), repeat Step 2 to recheck the cut-out adjustment.

4. When pressure cut-out switch stops the compressor at correct pressure, continue to operate coach engine and air conditioning system until pressure is equalized, then observe reading on pressure gauge when circuit is completed to compressor clutch drive. If switch does not permit points to close at 310 ± 5 psi gauge pressure, the complete control unit should be replaced.

5. After completing tests and adjustments, install cover and hole plugs.

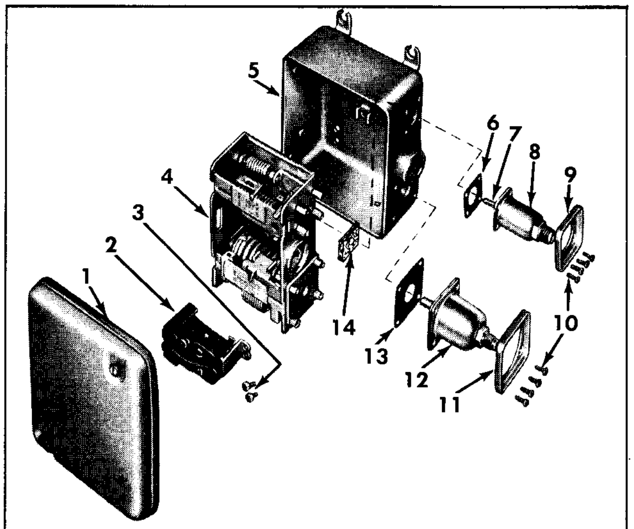
PRESSURE SWITCH REPLACEMENT

1. Pump down system as directed later under "SYSTEM SERVICES AND TESTS."

2. Back-seat compressor suction valve to close line to low pressure fitting at switch.

3. Disconnect refrigerant pressure lines and immediately cap line fittings to seal moisture and air from system.

4. Reverse the above procedure to install pressure switch.



1 Cover and Seal Assy.
2 Switch Contact Assy.
3 Attaching Screws
4 Switch Actuating Assy.
5 Switch Box
6 Gasket
7 Plunger Shaft
8 High Pressure Bellows Assy.
9 Bellows Retainer
10 Attaching Screws
11 Bellows Retainer
12 Low Pressure Bellows Assy.
13 Gasket
14 Anti-rattle Pad

TPM-9453

Figure 6—Hi-Lo Pressure Switch Components

5. After installing switch assembly, place system back in operating position, then vent or crack line connections at switch. Tighten connections firmly after purging.

NOTE: If system was left open for an extended period of time it may be necessary to evacuate that portion of the system.

PRESSURE SWITCH BELLOWS AND CONTACT REPLACEMENT

NOTE: Three subassemblies of "HI-LO" pressure switch are available for service: the high and low pressure bellows (8 and 12, fig. 6), and the switch contact assembly (2, fig. 6). The following describes replacement procedure of above mentioned parts. Bellows should be replaced if refrigerant is leaking into switch box, which may be due to a broken diaphragm within bellows. The switch contact assembly should be replaced if arcing is noted when switch contacts open and close, or if current flow check indicates failure of current to pass through switch.

Disassembly

NOTE: Key numbers in text refer to figure 6.

1. Remove four screws (10) which attach high and low pressure bellows (8 and 12) to switch box (5). Remove bellows retainers (9 and 11), the bellows, and gaskets (6 and 13).

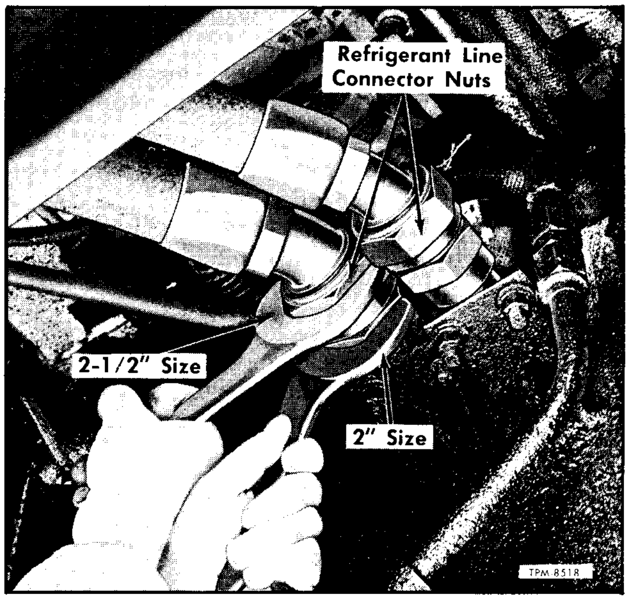


Figure 7—Using Wrenches at Line Connections (Typical)

NOTE: Be careful not to lose plunger shaft (7) from inside of high pressure bellows (8).

2. Remove cover (1) with cover seal from switch box.

3. To remove the switch contact assembly (2), remove two small screws (3) which attach contact mounting bracket to switch box. Lift switch contact assembly from box.

Installation

NOTE: Key numbers in text refer to figure 6.

1. Attach switch contact assembly (2) to box with two small screws (3). Tighten screws firmly.

2. NOTE: A square-shaped soft rubber pad (14) is located between switch box and switch actuator assembly (4) at the high pressure bellows. Bellows plunger shaft (7) must be inserted through hole in pad when installed.

3. Install high and low pressure bellows (8 and 12), gaskets (6 and 13), and retainers (9 and 11) with small screws (10). Tighten screws firmly.

IMPORTANT: Cap openings of bellows line fittings until such time switch assembly is installed.

REFRIGERANT LINE THREADED CONNECTIONS

To break the threaded line connections, use wrenches as shown in figure 7. A rubber O-ring seal (fig. 8) is used at flexible line connections and at condenser line connections to assure positive seal. A new O-ring seal should be installed when line connection has been broken.

The same method as shown in figure 7 is to be used to connect threaded lines. To connect flexible line to metal line, hand tighten connector nut on flexible line. Place wrench on hex nut of flexible line (fig. 8) and firmly tighten connector nut with proper wrench.

If O-ring seal is used, apply clean compressor oil to O-ring seal to facilitate connection. Check for leaks as explained later under "SYSTEM SERVICES AND TESTS."

IMPORTANT

Use GM replacement flexible metal lines. Other types of lines may, or may not, meet the necessary requirement of this system.

REFRIGERANT LINE SOLDERED JOINTS

Clean surfaces to be soldered using No. 00 steel wool, then apply thin coat of "Nokorode" flux. Sweat connection with special 95% tin and 5% antimony solder.

CLUTCH CONTROL AIR SOLENOID VALVE

Solenoid valve assembly is constructed as shown in figure 9. Foreign substances which may be present in compressed air system, may enter solenoid valve and injure valve faces and seats sufficiently to permit air leakage past valve rubber inserts when valves are seated. This condition may be detected easily on vehicle or on bench by testing valve ports with soap suds.

Valve assembly can be readily disassembled for cleaning, inspection, and replacement of parts.

DISASSEMBLY

NOTE: Key numbers in text refer to figure 9.

1. Remove threaded adapter (1) and seal (2) from sleeve assembly (4), then remove thin nut (3) which retains housing and coil assembly (5) to sleeve assembly.
2. Remove housing and coil assembly (5) by sliding off upper end of sleeve assembly.
3. Using special spanner wrench (skinner No. VO-233), unscrew sleeve retaining nut (6) from valve body (10), then remove sleeve assembly (4), plunger assembly (9), and plunger spring (8) from valve body.

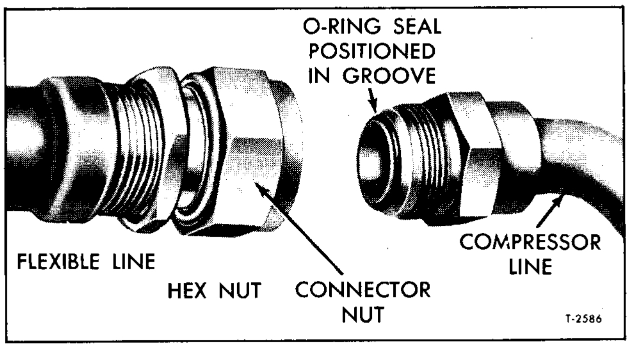
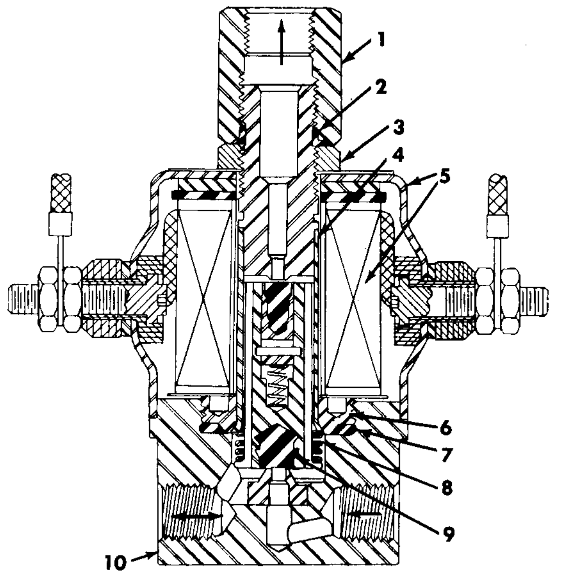


Figure 8—Refrigerant Line O-Ring Seal Installed

4. Remove sleeve nut seal (7) from valve body. Discard seals (2 and 7) and obtain new parts for assembly.

CLEANING AND INSPECTION

Wipe all parts clean with a clean cloth. Do not clean housing and coil assembly or plunger assembly in cleaning solvent. Examine rubber inserts in plunger assembly for wear or deterioration. Replace plunger assembly if damaged. Make sure valve seats on sleeve and in body are clean and smooth.



1 Adapter
2 Adapter Seal
3 Thin Hex Nut
4 Sleeve Assembly
5 Housing and Coil Assy.
6 Sleeve Retaining Nut
7 Sleeve Nut Seal
8 Plunger Spring
9 Plunger Assembly
10 Valve Body TPM-5756-1

Figure 9—Clutch Control Air Solenoid Valve (Typical)

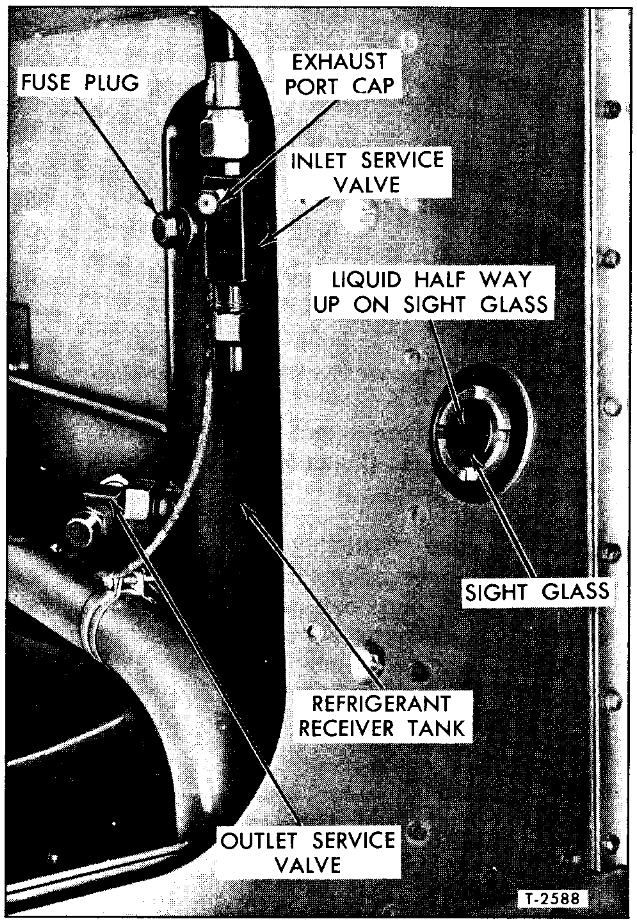


Figure 10—Refrigerant Receiver Tank and Sight Glass

ASSEMBLY

NOTE: Key numbers in text refer to figure 9.

1. Assemble plunger spring (8) on plunger assembly (9) and position plunger in valve body.
2. Place new seal (7), in body, then install sleeve assembly (4) in body and secure with sleeve retaining nut (6). Use special spanner wrench to tighten sleeve nut.
3. Install housing and coil assembly (5) over sleeve, then install thin nut (3). Tighten nut only as necessary to seat parts solidly; overtightening will place excessive strain on sleeve assembly.
4. Place new seal (2) in groove of adapter, then install adapter (1) on sleeve. Hold nut (3) while tightening adapter.

LIQUID REFRIGERANT RECEIVER TANK

Liquid receiver (fig. 10) serves as a reservoir for a constant supply of liquid refrigerant ready for use in the evaporator. A sight glass is provided at receiver in side of tank. A light bulb, installed at upper end of tank, is illuminated when light switch on right-hand side switch panel in front of driver is in either "ON" position. With light on, level of refrigerant can be readily seen in sight glass. After unit has been running for 30 minutes or more under maximum heat load, the refrigerant level should be at center of sight glass. In no case should the refrigerant level be above the sight glass or below it with the system operating. Refrigerant can be added to the system at the compressor suction valve test gauge fitting as directed in "SYSTEM SERVICES AND TESTS" later.

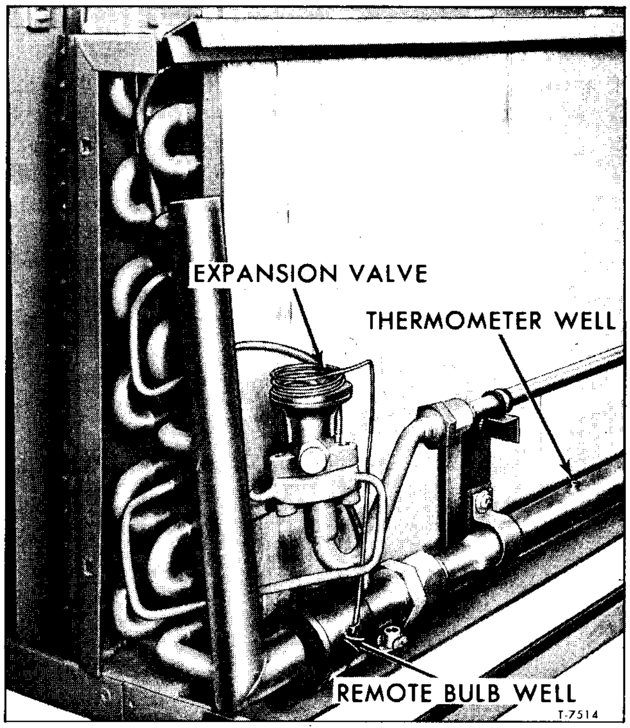


Figure 11—Expansion Valve Installed (Typical)

During operation of the system, both the receiver inlet and outlet valves must be fully open. To determine if valves are fully open, remove valve stem caps and turn valve stems counterclockwise to the limit of their travel. If air conditioning system fails to function, receiver valves should be the first place to check. The system positively will not function unless both of the receiver valves are open. A fusible safety plug (212°F.) is installed near top of receiver tank as shown in figure 10.

REFRIGERANT DEHYDRATOR STRAINER

The refrigerant dehydrator-strainer, installed in the liquid line at left side of coach (fig. 15), removes foreign matter and moisture from the refrigerant before it reaches the expansion valve.

Strainer is of the disposable type, charged with activated alumina. The complete unit is discarded and replaced with a new unit.

Chemical used in unit has a high moisture absorbing capacity. Any moisture which has been inadvertently admitted into system will be absorbed by the chemical. This does not mean that the system should not be evacuated when air and moisture has been admitted.

Whenever the system has been opened for any reason, the dehydrator-strainer should be replaced after a few hours of operation. Instructions for replacing unit are explained later in this group under "SYSTEM SERVICES AND TESTS."

REFRIGERANT EXPANSION VALVE

An additional expansion valve is used in conjunction with the evaporator mounted above the defroster heater core at front of coach. This valve is basically the same as the expansion valve installed in the underfloor compartment at right end of evaporator coil, except only one outlet is used on expansion valve at front of coach.

Expansion valve (fig. 11) is installed in the underfloor compartment at right end of evaporator coil as shown in figure 1 in "HEATING SYSTEM" section. Valve is accessible for servicing or replacement only after heating compartment access door and air filter screen have been removed. Expansion valve is set at the factory to provide the most efficient operation of the system, and should not normally require adjustment in the field. However, in the event a new evaporator coil and valve assembly or a new expansion valve power or cage assembly is installed, valve must be adjusted to provide the correct superheat at the evaporator outlet. In any event, do not adjust the expansion valve to compensate for insufficient cooling until all other possible causes are checked for and corrected.

EXPANSION VALVE OPERATION

NOTE: An expansion valve is also used at front evaporator.

Expansion valve is a manifold type thermo valve with external remote control bulb and external equalizer. Expansion valve regulates the flow of liquid refrigerant into the evaporator coils. Valve is operated by the temperature of

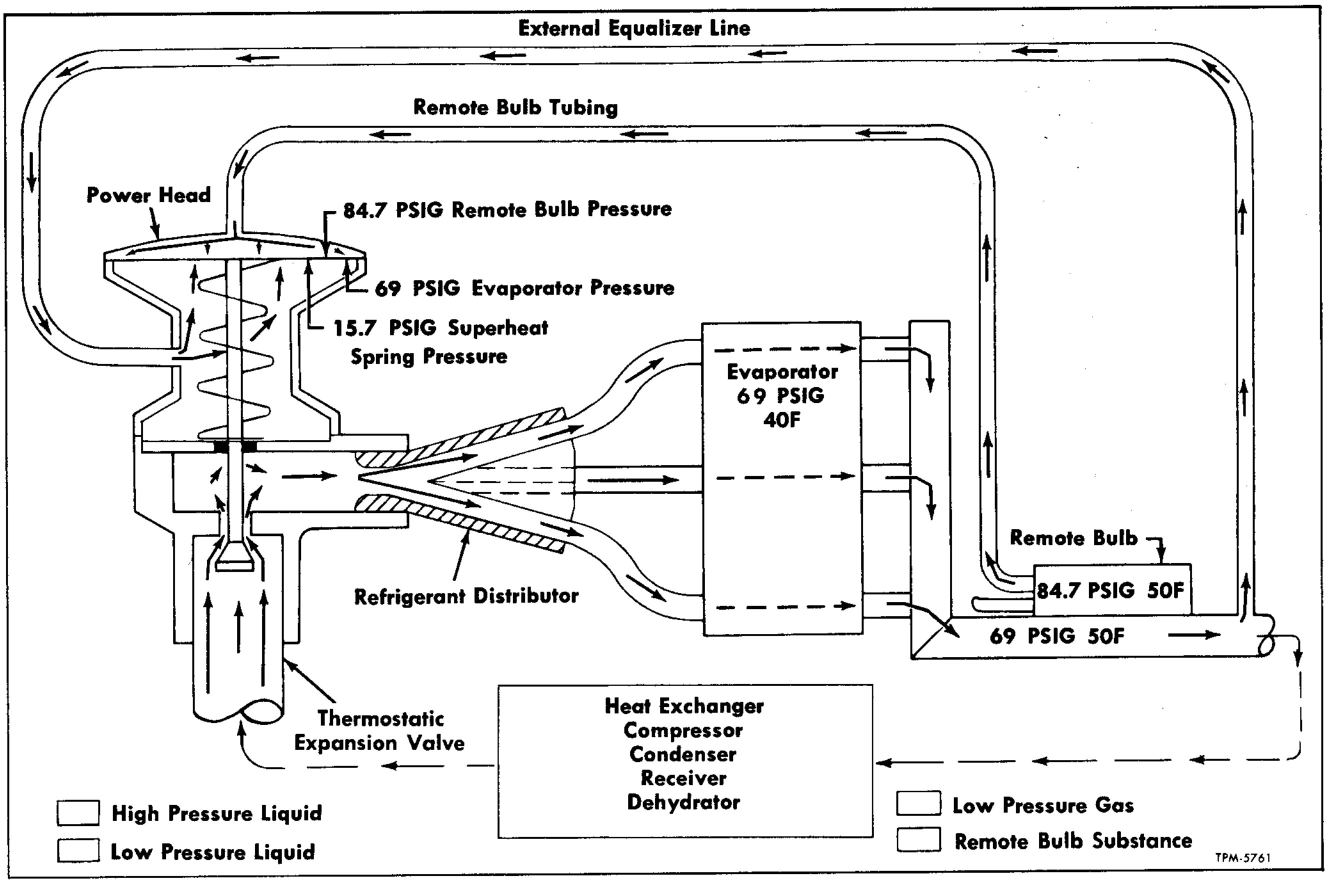
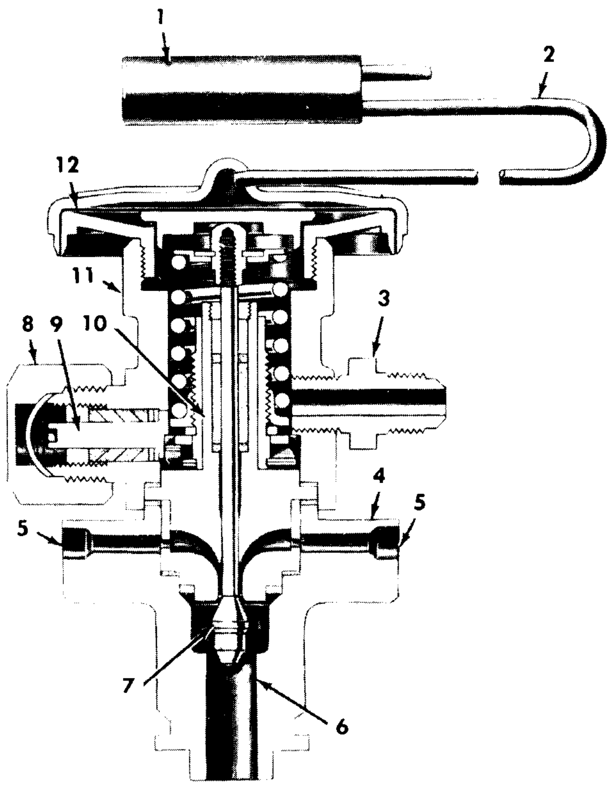


Figure 12—Simplified Diagram of Expansion Valve Operation (Typical)

the suction gas leaving the evaporator, and by the pressure in the evaporator through the equalizer tube. The combined effect of these two factors automatically control the quantity of liquid admitted into the evaporator. See figure 12, which shows schematic view of valve operation.

Outlet end of valve is of manifold type, which is connected by three small distributor tubes to the evaporator coils. The liquid line is connected to inlet port which extends through the center of the body flange. The remote bulb is clamped on the evaporator coil outlet manifold, where it is subjected to the temperature of the suction gas as it leaves the evaporator. Bulb is charged with gas refrigerant which expands and contracts in accordance with the temperature of the suction gas. Expansion of refrigerant in bulb applies pressure against diaphragm in valve power assembly, causing valve to open.

Bulb tends to operate valve toward its open or closed position to regulate the flow of refrigerant into the evaporator as required. If too much liquid is admitted into the evaporator, all of it does not evaporate and some liquid approaches the remote bulb, lowering its temperature. This will cause the liquid in the bulb to contract, relieving pressure on diaphragm, and spring moves valve toward its closed position. If there is not enough liquid in the evaporator, the resulting increase in temperature of the suction gas raises temperature of bulb, causing valve to operate in it opening direction.



1 Remote Bulb	7 Valve
2 Capillary Tube	8 Adjusting Stem Cap
3 Equalizer Tube Connector	9 Adjusting Stem
	10 Cage Assembly
4 Body Flange	11 Power Assembly
5 Outlet Ports	12 Diaphragm
6 Inlet Port	

Figure 13—Sectional View of Expansion Valve

EXTERNAL EQUALIZER

The purpose of the external equalizer is to prevent flooding the evaporator coils when temperature of evaporator suddenly rises. Equalizer tube is connected into the evaporator coil outlet manifold and to the cavity below the diaphragm in the valve power assembly. Thus, when valve is suddenly opened wide by a high temperature in the suction gas, the heavy flow of liquid into the evaporator creates a high pressure which is carried to the underside of the diaphragm through the equalizer tube. This pressure below the diaphragm counteracts the pressure from the remote bulb and tends to move the valve toward its closed position.

CONSTRUCTION (Fig. 13)

The expansion valve has three basic component parts: The power assembly, cage assembly, and body flange. There are no working parts in the body flange. The outlet body flange is soldered to evaporator by tubes and a tube distribution manifold. Power assembly and cage assembly can be removed from the body flange without breaking any soldered connections.

Always make sure the system is clean and dry before installing the expansion valve.

SUPERHEAT

Superheat is the temperature increase of a gas, above the saturation point. When the liquid refrigerant boils or evaporates in the evaporator, heat is absorbed from the air passing through the evaporator coils, but the temperature of the gas does not rise above the boiling point until all the liquid has changed to gas. The heat thus absorbed is the latent heat of vaporization, producing a change in state with no change in temperature.

After all the refrigerant has changed to gas, the temperature of the gas is still lower than the temperature of the air passing through the evaporator, so the gas will continue to absorb heat from the air and its temperature will rise a few degrees. This amount of rise above the saturation temperature is called "superheat."

Example: At 69 psi gauge pressure, the saturation temperature of refrigerant is 40°F.; that is, the liquid changes to gas at 40°F. If the temperature of the refrigerant gas at 69 psi gauge pressure is 48°F., the gas contains 8°F., of superheat. Superheating takes place after all the liquid has changed to gas, usually near the outlet end of the evaporator coils.

PRESSURE - TEMPERATURE

Pressure has a very definite relationship to the boiling point of any substance. There is a definite temperature at which a liquid will boil for every definite pressure exerted upon that liquid. Water, which boils at 212°F., under zero gauge pressure (atmospheric pressure at sea level), will boil at approximately 232°F., under 10 psi gauge pressure.

Likewise, refrigerant boils at -41°F. (-41°F. below zero) under atmospheric pressure, and at 40°F. under 69 psi gauge pressure. An increase in pressure causes a rise in the boiling point.

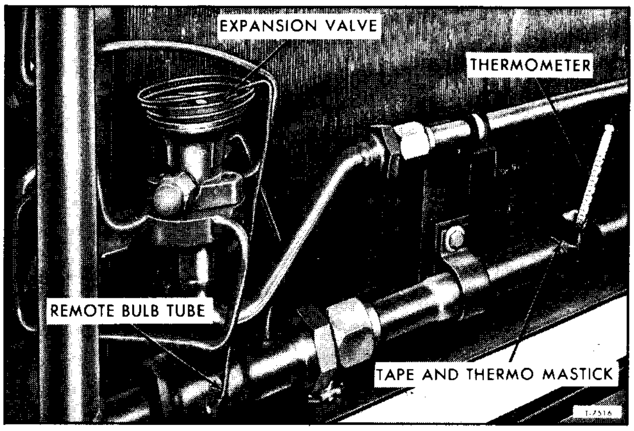


Figure 14—Checking Superheat

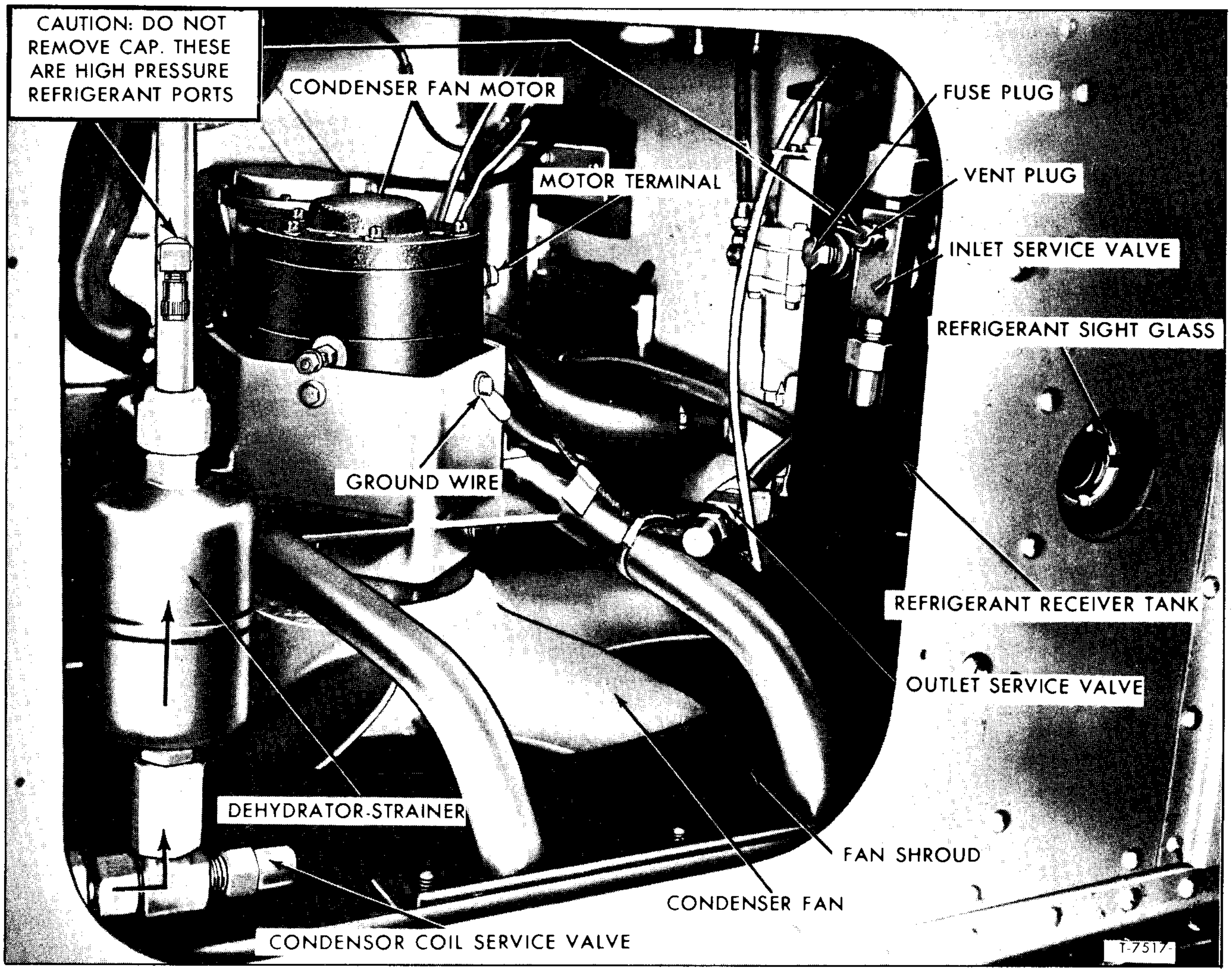


Figure 15—Condenser Compartment Viewed Through Bulkhead (Typical)

The pressure temperature relationships shown in the table following are used for two purposes: for adjusting the expansion valve and for checking for air in the system. Method of checking for air in the system is described in "SYSTEM SERVICES AND TESTS" later in this group.

EXPANSION VALVE ADJUSTMENT

Valve should be adjusted to obtain 15° to 19° superheat with moderately heavy internal load. Refer to pressure-temperature chart.

1. Apply small quantity of a thermo-type mastick to a remote-reading thermometer (if available) and attach to evaporator coil outlet or place thermometer in special thermometer well and wrap with thermo-mastic, as shown in figure 14. Thermo-mastic may be available at a local refrigeration service establishment, or it can be obtained from the Alco Valve Company, St. Louis, Missouri. Cover thermometer more than shown.

REFRIGERANT PRESSURE - TEMPERATURE RELATIONSHIP - For R-22

Temp. °F.	Gauge Pressure Psi	Temp. °F.	Gauge Pressure Psi
30	55	96	187
32	58	98	192
34	60	100	198
36	63	102	204
38	66	104	201
40	69	106	216
42	72	108	222
44	75	110	229
46	78	112	235
48	81	114	242
50	85	116	249
52	88	118	256
54	92	120	263
56	95	122	270
58	99	124	277
60	103	126	284
62	106	128	292
64	110	130	299
66	114	132	307
68	118	134	315
70	123	136	324
72	127	138	332
74	131	140	341
76	136	142	350
78	140	144	359
80	145	146	369
82	150	148	378
84	155	150	388
86	160	152	392
88	165	154	401
90	170	156	411
92	175	158	422
94	181	160	433

2. Connect a low pressure gauge at the compressor suction valve test gauge fitting. Loosen line connection at gauge and expel air from line.

3. Add two (2) lbs. pressure to gauge pressure to compensate for line loss and compare this pressure with temperature reading on thermometer against corresponding pressure in table. If necessary, remove cap from expansion valve adjusting stem; turn valve stem clockwise to decrease flow of refrigerant and increase superheat; turn valve stem counterclockwise to increase refrigerant flow and lower superheat. Two complete turns of valve stem will change the superheat approximately 1°F.

4. After adjusting, wait about 30 minutes to check results.

5. Remove gauge and line, then install protector cap on test gauge fitting.

NOTE: If superheat is lower than recommended, check the following:

a. Temperature in coach may be too low.
b. Expansion valve adjustment necessary.
c. Valve stuck open.
d. Fouled evaporator.

If superheat is higher than recommended, check the following:

a. Expansion valve adjustment necessary.
b. Defect in expansion valve.
c. Low on refrigerant.
d. Obstruction in system low pressure side circuit.

SERVICING THE EXPANSION VALVE (Fig. 13)

When necessary to clean, inspect, or replace parts, the power assembly and cage assembly may be removed without disconnecting any soldered joints.

1. Pump down the system as directed in "SYSTEM SERVICES AND TESTS," later in this group.

2. Disconnect the external equalizer line from power assembly. Unclamp remote bulb from evaporator coil outlet manifold tube. Use care to prevent kinking or otherwise damaging capillary tubing.

3. Remove two cap screws attaching power assembly to body flange, remove power assembly, then lift out cage assembly.

4. When assembling valve, replace gaskets in proper places, and be sure the retaining pin on the valve cage enters the slot in the body flange.

5. Make sure the two lugs on the valve cage fit into grooves in the proper assembly, and that the gear wheel on cage assembly meshes with adjusting gear in side of power assembly. Do not

force the valve together - make the cage fit properly before tightening to the body flange.

CAUTION: If necessary to make brazed connections at body flange, first remove power assembly, cage assembly, and all gaskets. Keep heat away from all valve parts except the body flange.

6. Install remote bulb in special remote bulb well, making sure there are no kinks in the capillary tube.
7. Evacuate or purge as required.

EXPANSION VALVE FREEZES

Expansion valve trouble may be caused by moisture in the system. Excessive refrigerant causes a hissing sound accompanied by a pounding vibration. When operating at low temperatures, moisture is indicated by the above, and by the fact that when the compressor is shut down and the valve warms up, it will become operative again for a short time.

If there is moisture in the system, it is necessary to evacuate the system with a vacuum pump, then service the dehydrator-strainer. If moisture is still evident after one hour of operation, the dehydrator-strainer must be serviced again. Repeat until all moisture has been eliminated. Moisture trouble is caused by moist air entering piping when system is open, or from water in refrigerant container. Piping should be blown out with refrigerant before making final connections, particularly if piping has been open to air with high humidity content. After system has been pumped down and system opened, moisture is almost certain to be introduced. Always service the dehydrator-strainer whenever the system has been opened and service again after a few hours of operation.

Many chemical preparations to be added to the refrigerant are now offered commercially for correcting moisture trouble. These preparations are anti-freeze solutions and are not suitable for use in compressor used in this system.

THE BEST PRACTICE IS TO ALWAYS SERVICE THE DEHYDRATOR-STRAINER WHENEVER THE SYSTEM HAS BEEN OPENED.

This absorbs the moisture rather than preventing it from freezing, and also eliminates the danger of corrosion of internal parts.

EVAPORATOR

NOTE: An additional evaporator is mounted above the defroster heater core at front of coach.

Finned tube-type evaporator coil assembly is mounted in heating and cooling compartment under floor as shown in figure 1 in "HEATING SYSTEM" section in this supplement. If the underfloor air filter screen installed forward of the evaporator is serviced frequently enough, there should be no maintenance required on the evaporator. However, if servicing the filter is neglected, some particles of dust, lint, etc., will pass through the filter; since the evaporator coils and fins are moist, these particles will cling to them. Dirt on the coils and fins acts as insulation and reduces the efficiency of the system, and when operating in humid climates, objectionable odors may develop caused by a mold-like formation or growth. In the event the evaporator does become dirty, it must be cleaned with air pressure and water and some cleaning agent which is not harmful to the aluminum tubes and fins. Since the location of the evaporator is not conductive to thorough cleaning in the vehicle, and considerable time is required for removing the evaporator for cleaning; the importance of cleaning or changing the air filter at frequent intervals should be impressed upon all maintenance personnel.

AIR FILTER SCREEN

AIR FILTER SCREEN, LOCATED IN THE UNDERFLOOR COOLING AND HEATING COMPARTMENT, MUST BE KEPT CLEAN FOR SATISFACTORY OPERATION OF AIR CONDITIONING SYSTEM.

Instructions for cleaning the air filter screen are explained in "HEATING SYSTEM" section in Maintenance Manual X-6814.

UNDERFLOOR BLOWER AND MOTOR

Complete maintenance instructions on the underfloor blower and motor are covered in "HEATING SYSTEM" section.

CONDENSER COMPARTMENT

Condenser compartment is located on left side of coach, forward of forward baggage compartment. Compartment contains the condenser coil, filter screen, condenser cooling fan, fan motor, dehydrator-strainer, and refrigerant receiver tank. Figures 15 and 16 show components of compartment.

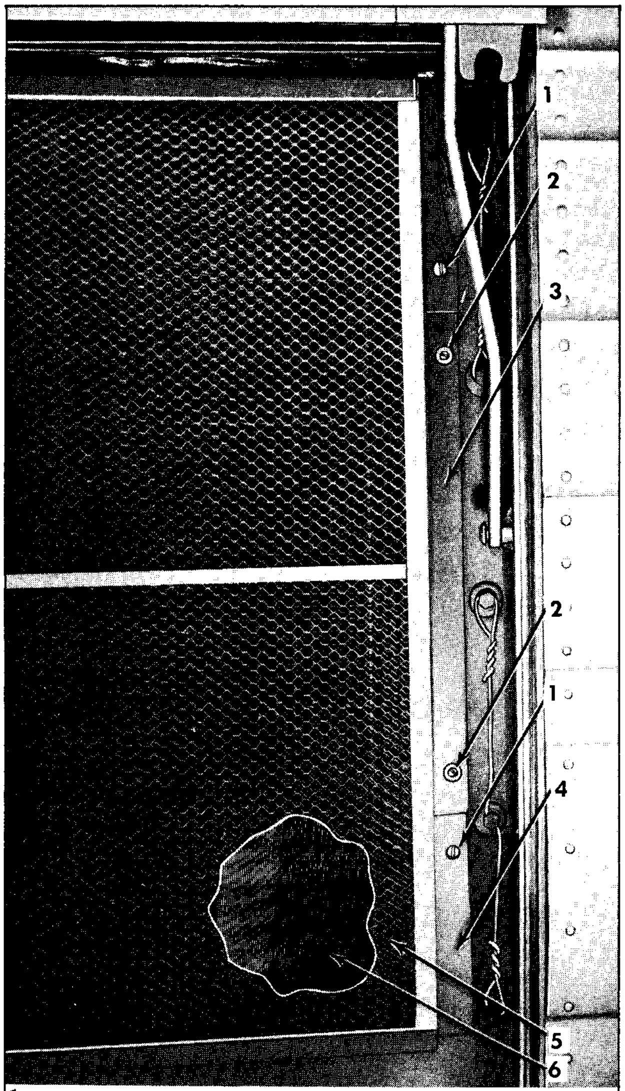
Access to the condenser coil and filter screen is through the condenser compartment door on left side of coach. Access to condenser cooling fan,

fan motor, dehydrator-strainer, and refrigerant receiver tank is through left opening in forward baggage compartment bulkhead.

CONDENSER COIL

The condenser coil (fig. 16) is the medium through which the heat picked up by the refrigerant in the evaporator and the heat of compression is dissipated to outside air. Since the heat in the gas must be dissipated through the walls of the coils and the fins, it is of extreme importance that the condenser be kept clean. When condenser becomes clogged or coated with dirt and road film, high head pressure occurs and extra operating power is required. Condenser must be cleaned at regular intervals.

THE IMPORTANCE OF KEEPING THE CONDENSER CLEAN CANNOT BE OVEREMPHASIZED. Instructions for cleaning condenser coil are explained later under "SYSTEM SERVICES AND TESTS."



1 Fastener
2 Screw and Washer
3 Retainer
4 Frame Assembly
5 Air Filter
6 Condenser Coil

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Figure 16—Condenser Coil and Filter (Typical)

CONDENSER FILTER SCREEN

(Refer to Figure 16)

Air filter (5), mounted in front of condenser coil (6), filters all air passing through to condenser coil. Filter is accessible after opening condenser compartment door on left side of coach.

1. Turn fasteners (1) one-quarter turn. Swing out filter and filter frame assembly.
2. Remove two screws, washers, and nuts (2), securing retainer (3) to frame assembly (4). Remove retainer.
3. Slide filter (5) out of frame assembly (4).
4. Clean filter as previously explained in "HEATING SYSTEM" section under "Underfloor Air Filter Screen" (except Do Not Oil).

Install filter as follows:

1. Slide filter (5) into frame assembly (4).
2. Install and secure retainer (3) to frame assembly with two screws, washers, and nuts.
3. Swing filter and frame assembly toward condenser coil and turn fasteners (1) one-quarter turn to secure filter and frame assembly.

Clogging the filter screen restricts air circulation, thus reducing efficiency of system. In addition to the affect of system operation, dirty filter will permit dirt to pass into condenser coil, clogging coils and fins.

CONDENSER FAN AND DRIVE

The condenser fan motor is operated from the 24-volt coach electrical system. The fan motor operates at approximately 1700 rpm on low speed and approximately 2350 rpm on high speed.

Location of fan and motor is shown in figure 15. Refer to "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits and connections.

Condenser fan is of six blade-type and is mounted in bottom of condenser compartment. Fan pulls outside air through the condenser coil and discharges it through screened opening at bottom of compartment.

The fan blade is adjustable on motor shaft to provide alignment with shroud opening. Instructions for aligning fan blade are explained later under "FAN BLADE REPLACEMENT."

DESCRIPTION AND OPERATION

The condenser fan speed is maintained by the condenser fan magnetic switch, the high speed pressure switch, the condenser fan high speed relay, and a high speed resistor. Speed control is maintained by the high speed pressure switch which closes at 325 psi condenser pressure and opens at 290 psi condenser pressure to energize and de-energize the high speed relay. The motor operates continuously when "HEAT-AIR COND." switch is in "AIR COND." position and, therefore assures a more rapid condenser pressure drop in the event of high pressure cut-out.

CHECKING SYSTEM OPERATION

Check "cut-in" and "cut-out" pressure of "Hi-Speed" pressure switch with engine running and "HEAT-AIR COND." switch in "AIR COND." position. Condenser fan motor should go to high speed when system pressure reaches 325 ± 5 psi then return to low speed when system pressure drops to 295 ± 5 psi.

Check condenser fan motor at both high and low speed conditions with engine running at fast idle and "HEAT-AIR COND." switch in "AIR-COND." position. Connect an ammeter in series with the 2-gauge red lead at the condenser fan magnetic switch and note the reading. Ammeter reading should be 83 ± 5 amps on high speed and 45 ± 5 amps on low speed. Connect an ammeter in series with the 16 gauge (yellow-red tracer) lead at the condenser fan high speed relay and note the reading. Ammeter reading should be 3.5 ± 1.0 amps on high speed and 7.0 ± 1.0 amps on low speed.

If condenser fan motor speed is not within specified limits, check the following.

No Motor Operation

1. "HEAT-AIR COND." switch not in "AIR COND." position.
2. Low system voltage - condenser fan magnetic switch not operating.
3. No ground strap on condenser fan motor.
4. Battery compartment 90-amp circuit breaker has operated or failed to open.

Low Speed Motor Operation Only

1. Failure of high speed pressure switch to operate, contacts remain open. Switch setting should be 325 ± 5 psi, and differential setting should be 30 ± 5 psi.
2. Condenser fan high speed relay not energized, contacts remain closed - poor or no ground on the relay.
3. High speed resistor shorted out.

Motor Operates Only At High Speed

1. High speed pressure switch remains closed. Switch should open at 295 ± 5 psi.
2. Condenser fan high speed relay is not returning to the normally closed position, poor or no relay ground.

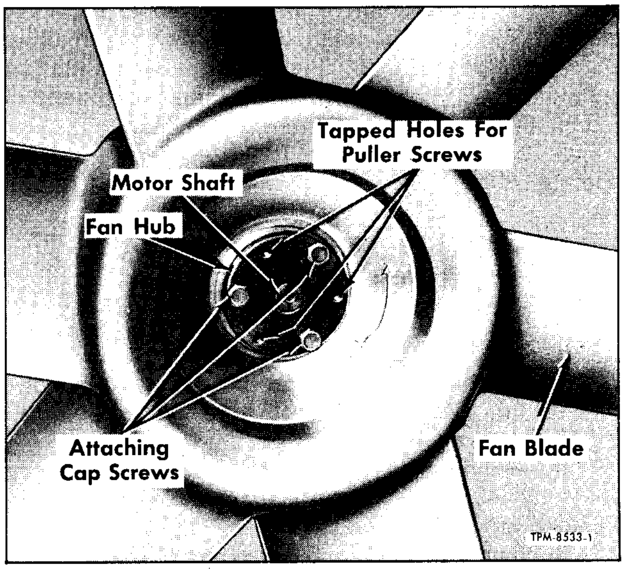


Figure 17—Condenser Fan Blade Installation

FAN BLADE REPLACEMENT

IMPORTANT: Before removing or installing the condenser fan, disconnect wire from motor terminal (fig. 15) to prevent possibility of motor being energized.

Removal

1. From underneath coach, remove filter screen over bottom opening of condenser compartment.
2. Loosen three cap screws which secure fan blade to fan hub (fig. 17). Screws should be loosened to relieve clamping effect of fan hub on motor shaft.
3. Install three long puller screws in tapped holes of fan hub shown in figure 17, then tighten screws evenly to separate fan from hub and to force from motor shaft. Remove hub and fan blade.

CAUTION: Handle fan blade carefully.

Installation

NOTE: Fan hub should be opened slightly (wedge and press) to permit installation over motor shaft.

1. Position fan blade over taper of fan hub and secure loosely with three attaching cap screws.
2. Locate drive key in keyway of motor shaft, then slowly place fan blade and hub over motor

shaft and into alignment with shaft key. Push fan hub onto shaft to a position whereby the leading edge of blade fin is flush with edge of shroud opening rim. Tighten three attaching cap screws alternately to 7 to 10 foot-pounds torque.

3. Install and secure filter screen to bottom opening.

CONDENSER FAN DRIVE MOTOR REPLACEMENT

REMOVAL (Fig. 15)

1. Disconnect wiring from terminals on condenser fan motor. Tag each wire to aid in identification at time of installation.

2. Remove fan blade from drive end of motor shaft as explained previously under "Fan Blade Replacement."

3. Support motor, then remove bolts which attach motor to mounting bracket. Remove the motor.

INSTALLATION (Fig. 15)

1. Position motor assembly through mounting bracket, then install bolts and washers to secure. Tighten mounting bolts to 25-30 foot-pounds torque.

2. Install fan blade and hub on motor shaft as explained previously under "Fan Blade Replacement."

3. Connect wiring to terminals on condenser fan motor referring to identification made at time of removal.

4. Operate motor and check output as previously explained under "Checking System Operation."

CONDENSER FAN DRIVE MOTOR OVERHAUL

MOTOR DISASSEMBLY (Fig. 18)

1. Remove cover band from field frame.

2. Through openings in field frame, remove screw and washer attaching each brush lead to the terminal and connector assembly.

3. Using a hooked tool, lift brush spring up off the brush, then, remove each brush and lead assembly from the brush holder.

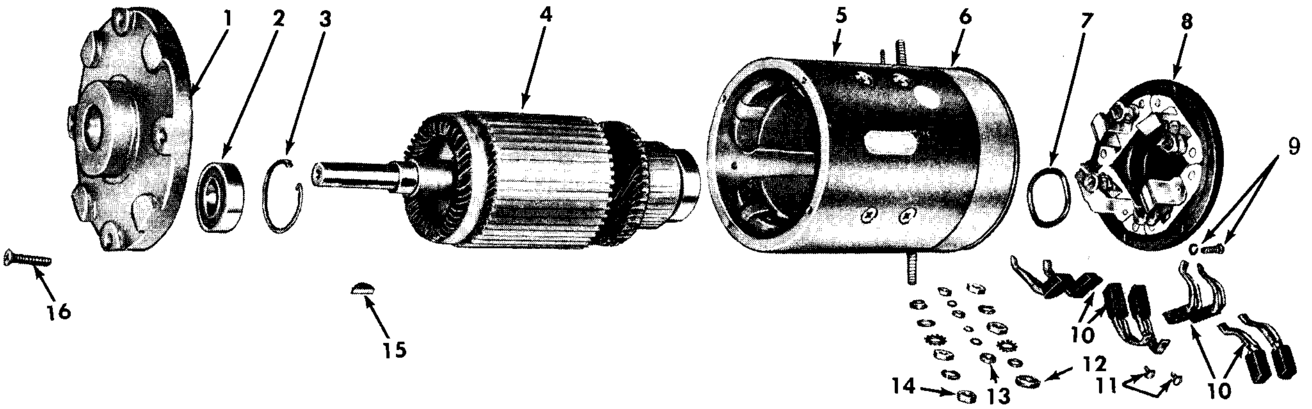
4. Remove screws which attach drive end frame to field frame. Remove drive end frame with armature from field frame.

5. Support drive end frame in an arbor press, then remove armature and shaft from end frame.

6. Remove snap ring from drive end frame, then carefully tap sealed bearing from drive end frame.

7. Remove screws and washers which attach commutator end frame to field frame. Remove commutator end frame from field frame. Remove spring washer from commutator end frame.

NOTE: Brush holders are riveted to the commutator end frame.



1 Drive End Frame
2 Drive End Frame Bearing (Sealed)
3 Snap Ring
4 Armature, Shaft and Bearing Assembly
5 Field Frame, Field, and Terminal Assembly
6 Cover Band
7 Spring Washer
8 Commutator End Frame, and Brush Holder Assembly
9 End Frame to Field Frame Screw and Washer
10 Brush and Lead Assembly
11 Brush Lead to Terminal Screw and Washer
12 Terminal Assembly "A"
13 Terminal Assembly "F"
14 Terminal Assembly "G"
15 Woodruff Key
16 Drive End Frame to Field Frame Screw

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Figure 18—Condenser Fan Drive Motor Components

CLEANING AND INSPECTION

With motor disassembled, except for removal of field coils, component parts should be cleaned and inspected as described following:

1. Wipe motor components to clean. DO NOT use degreasing solvents for cleaning armature, brushes, bearings, and field coils.

2. Inspect brush holders, springs, and brushes for wear or damage. If brushes are worn to one-half their original length replace the brush assembly. If brush holder is damaged, replace the commutator end frame.

3. Inspect armature shaft at surfaces contacted by the drive end frame bearing. A damaged shaft will require replacement of the armature assembly.

4. Inspect commutator end frame bearing. NOTE: Bearing will remain on armature shaft when drive end frame and armature was removed from the field frame.

If bearing is not in good condition, it must be replaced as directed under "Commutator End Frame Bearing Replacement" later in this section.

5. Inspect commutator for rough or out-of-round condition.

Armature

Check armature to commutator leads to make sure they are securely connected then check the armature for opens and grounds as follows:

OPENS - Inspect point where commutator riser bars are joined to the commutator for loose connections which can cause arcing and burning. If bars are not too badly burned, resolder riser bar leads using rosin flux solder. After soldering, turn down commutator and undercut insulation.

GROUNDS - Place one prod of a test lamp on commutator and the other prod on armature core or shaft. If test lamp lights, armature is grounded and should be replaced. Also, replace the armature if shaft is worn or damaged.

Field Coils

NOTE: Before checking field coils, disconnect field coil lead from field frame.

1. Place one test prod on field coil connector and the other on each field coil lead. If lamp does not light, coils are open-circuited.

2. Place one test prod on field frame and the other on each field coil lead. If lamp lights, coils are grounded.

3. If grounded or open circuit is indicated in series connected coils, break the connection between coils and test each coil separately to determine which one is defective and must be replaced. If any coil is replaced, make sure connections are securely soldered and properly insulated.

Commutator

If commutator is worn, dirty, out-of-round, or has high insulation, repair as follows:

1. Place armature in a lathe and turn down commutator to remove worn spots, out-of-round, or roughness. Do not cut deeper than necessary to clean up.

2. Undercut insulation between commutator bars 1/32". This undercut must be the full width of the insulation and flat at the bottom. After undercutting, carefully clean the slots to remove any trace of dirt or copper dust.

3. Sand commutator lightly with No. 00 sandpaper to remove any burrs left from undercutting.

Commutator End Bearing Replacement

1. Support inner race of bearing, then using an arbor press, press the armature shaft out against the bearing inner race.

NOTE: Because of the close tolerance between the bearing and armature assembly, it may be necessary to secure the bearing outer race. If this is the case, the bearing should be replaced.

2. Position bearing on armature shaft, then press bearing squarely onto shaft until flush with shoulder of shaft.

IMPORTANT: Press against bearing inner race during installation.

MOTOR ASSEMBLY

Refer to figure 18 for condenser fan motor components.

1. Carefully install sealed bearing in recess in drive end frame applying pressure to bearing outer race if necessary. Install snap ring to secure bearing in end frame.

2. Support commutator end of armature shaft in an arbor press, then install drive end frame over armature shaft until bearing inner race is in contact with shoulder on shaft.

3. Insert armature through field frame until drive end housing is aligned with field frame. Install screws to attach drive end frame to field frame. Tighten screws evenly and firmly.

4. Position spring washer in cavity in commutator end frame, then position commutator end frame on armature shaft being careful not to damage sealed bearing on shaft.

5. Install screws and washers to attach commutator end frame to field frame. Tighten screws evenly and firmly.

6. Using a hooked tool, lift brush spring up, then position each brush in brush holder. Position a brush spring on each brush assembly to secure.

7. Install a screw and washer at each terminal to connect each brush lead to the terminal and connector assembly.

8. Position cover band over field frame and attach with bolt and nut. Tighten bolt firmly.

REFRIGERANT COMPRESSOR

The refrigerant compressor, mounted at rear of coach (fig. 19), is a three-cylinder reciprocating type unit. It is self-lubricated and self-contained. The shaft seal is of the rotary-type, consisting of a stationary lapped seal face on the seal cover, with a spring-loaded rotating carbon nose ring sealing against the seal face of the stationary cover.

A neoprene seal ring between the carbon nose ring and spring acts as a seal around the shaft. The seal faces are flood-oiled under pressure at all times. A sight glass on the front of the compressor shows the oil level. Shut-off valves are provided at the compressor suction and discharge ports.

Compressor is shaft driven from coach engine by air-operated clutch. Clutch can be engaged when engine is operating in a range between 3 psi and 25 psi oil pressure. The clutch operation and maintenance information is explained later.

Compressor can be removed from coach with

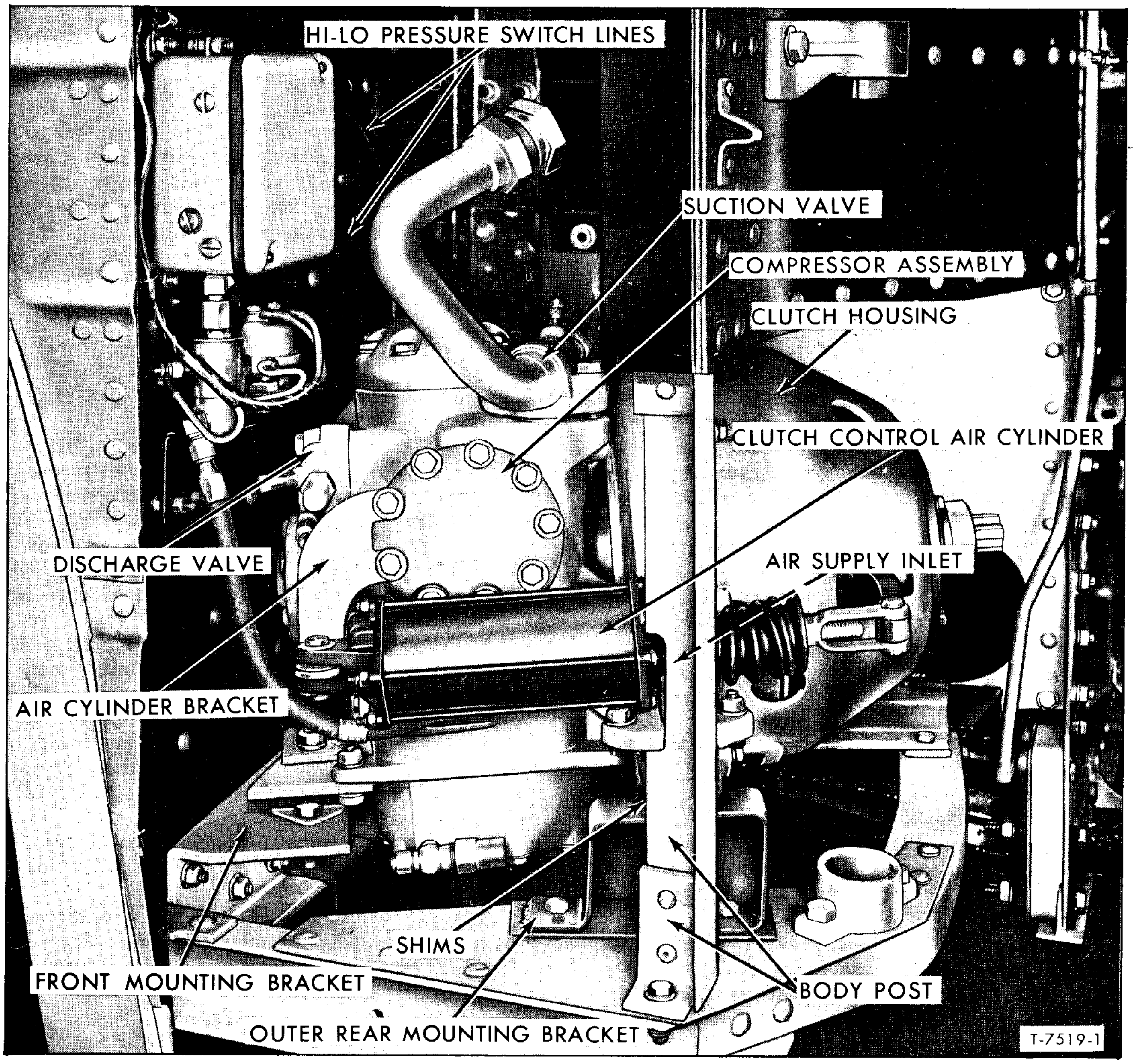


Figure 19—Air Conditioning Compressor Installed (Typical)

clutch mechanism attached. Removal procedures are explained later under "Compressor Replacement." Compressor overhaul instructions are also explained later under "Refrigerant Compressor Overhaul."

COMPRESSOR OPERATION

The aluminum body of the compressor is divided into three main sections -- the discharge or high pressure gas cavity, the suction or low pressure gas cavity, and the crankcase or housing.

Low pressure refrigerant gas is drawn into the compressor from the suction line. As the refrigerant gas enters the compressor it passes through a fine mesh strainer screen and then into the suction cavity. In the suction cavity, oil entrained with the refrigerant separates from the refrigerant and passes into the crankcase through two orifice holes. The low pressure refrigerant is drawn into the cylinder during the down-stroke of the piston through the cylinder suction valve which is mounted on the top of the cylinder liner. During the suction stroke of the piston, the cylinder discharge valve in cage on top of cylinder liner is closed. As the piston begins its compression stroke, the cylinder suction valve closes and compression begins. As the piston moves up on the compression stroke, the cylinder discharge valve opens, and the high pressure refrigerant gas passes through the valve into the discharge cavity. The gas then passes through the discharge cavity to the high pressure refrigerant line.

COMPRESSOR MAINTENANCE

Compressor requires practically no maintenance other than making sure that sufficient (but not too much) oil and refrigerant is maintained in the system at all times. The lubrication system of the compressor will fail if the system loses its charge of oil or refrigerant. Both oil and refrigerant must be circulating through the compressor whenever it is running to prevent very serious damage. Check compressor mounting bolts and alignment periodically. Check carefully for indication of oil or refrigerant leakage. Leakage should be remedied promptly to prevent excessive refrigerant and oil loss. If necessary, compressor can be overhauled as explained later under "Refrigerant Compressor Overhaul."

COMPRESSOR LUBRICATION

The compressor crankcase serves as a reservoir for the main oil charge. A portion of the lubricating oil circulates with the refrigerant, and this oil is separated from the refrigerant as the refrigerant passes through the suction cavity of the compressor. As the low pressure refrigerant and oil separate in the suction chamber, the oil goes to the bottom of the chamber, and the gas goes to the top of the chamber. The oil passes from the suction chamber to the crankcase through two drain orifice holes.

During the "OFF" cycle of the compressor, refrigerant tends to collect and condense in the crankcase. The liquid refrigerant mixes with the oil in the crankcase. When the compressor begins to operate, there is a rapid reduction of pressure in the crankcase above the oil level. This permits the liquid refrigerant to evaporate out of the oil. As the refrigerant boils off and leaves the crankcase, the oil tends to foam and leave with the refrigerant.

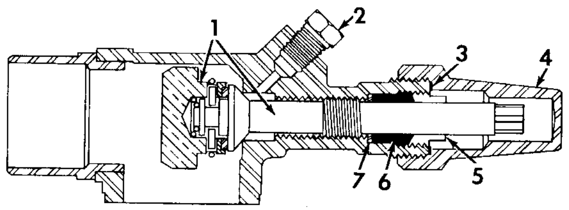
Compressor lubrication is accomplished by a force feed, direct drive, positive displacement pump, which is mounted to the end of the crankshaft. Oil from the crankcase is drawn into the pump through a tube which connects the pump to a fine mesh strainer located in the sump of the crankcase. This strainer scavenges oil from the bottom of the crankcase and prevents the entrance of foreign particles into the oil circulating system.

Pump forces oil into discharge end main bearing after which it enters end of crankshaft. Crankshaft oil passages are arranged to feed from inside of crankshaft throw. Two magnetic plugs in crankshaft oil passages trap steel particles. Oil escapes between rod bearings and is converted into mist to lubricate wrist pins and cylinder walls. Oil flows from drive end of crankshaft into crankshaft seal chamber.

It is highly important that only the recommended refrigeration compressor oils which contain a de-foamant be used in this compressor. The approved oils for use in this compressor are listed at end of this section. These oils can be obtained locally through refrigeration equipment suppliers. Oil should be purchased in sealed cans only. Never use bulk oil or oil which has been exposed to air.

IMPORTANT: USE ONLY APPROVED COMPRESSOR OILS.

The initial charge of oil in the compressor is approximately 5.3 pints. After the compressor has been operated for about 30 minutes at engine idle speed, and engine has obtained normal operating temperature, the oil level should be about 1/2 to 3/4 up on the sight glass. If oil is near or below the bottom of the sight glass, oil should be added. The oil level should always be checked with the compressor operating. Before adding oil, first determine and correct cause of loss of oil. A new compressor or one having been overhauled



1 Valve and Stem Assembly
2 Test Gauge Connection
3 Cap Gasket
4 Cap
5 Packing Gland
6 Packing
7 Packing Washer

Figure 20—Compressor Refrigerant Valves (Typical)

should be drained and refilled after the first 200 hours of operation. Refer to "Servicing Compressor Oil Charge" in "SYSTEM SERVICES AND TESTS" section.

COMPRESSOR SHUT-OFF VALVES

Double-seating shut-off valves (fig. 20) are provided at the compressor discharge and suction ports. With both valve stems turned all the way in (clockwise - closed), compressor is isolated from the rest of the system. "Open Position" of valves, frequently referred to in this section, is with the valve stem in the full back-seated position as shown in figure 20, then turned 1/4 to 1/2 turn off back-seated position.

IMPORTANT: Valve stem caps with gaskets must be in place and tight at all times during system operation.

COMPRESSOR STORAGE

If compressor is removed from coach and is to remain in storage (less the clutch unit), stand the compressor on end, drive end down, on blocks in such a way that no weight rests on the compressor shaft.

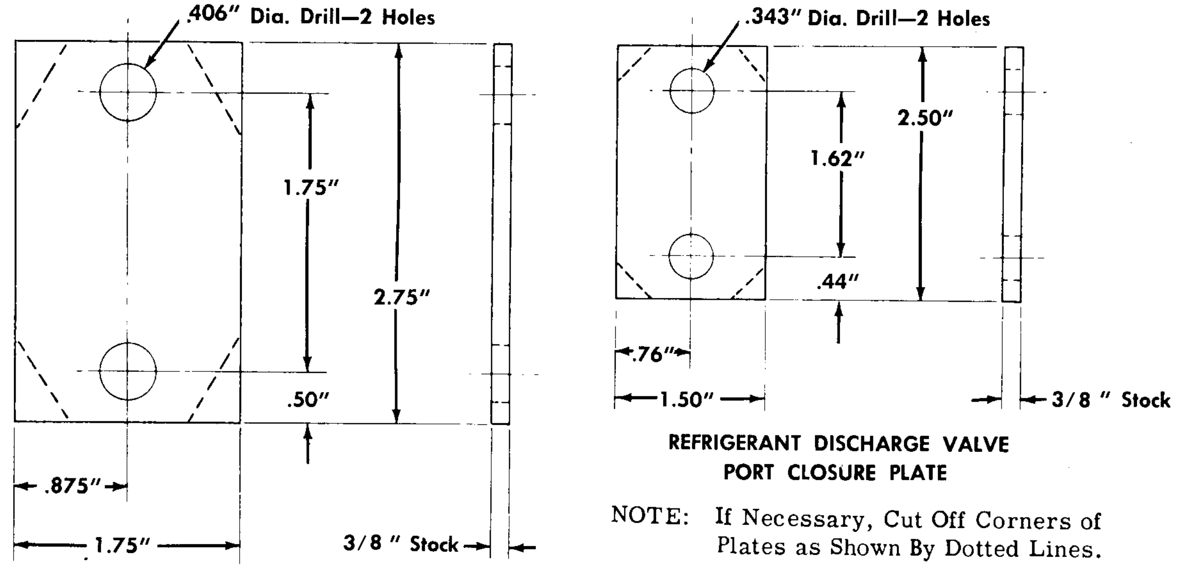
COMPRESSOR REPLACEMENT

Compressor is removed from coach with the clutch assembly attached. Before removing compressor, pump down the system as directed under "Pumping Down the System" in "SYSTEM SERVICES AND TESTS" section.

REMOVAL (Fig. 19)

IMPORTANT: Closure plates shown in figure 21 are used to cover the valve ports and should be made available before beginning to remove compressor.

1. Position rear wheels of coach on four to six-inch run-up blocks. This is not absolutely necessary, but will provide easier access for making lower disconnections.
2. Remove stone shield from below compressor compartment.
3. Disconnect clutch control cylinder air line, then temporarily apply shop air pressure (65 psi or more) to cylinder.



REFRIGERANT DISCHARGE VALVE PORT CLOSURE PLATE

NOTE: If Necessary, Cut Off Corners of Plates as Shown By Dotted Lines.

REFRIGERANT SUCTION VALVE PORT CLOSURE PLATE

Figure 21—Closure Plates for Sealing Compressor Valve Ports

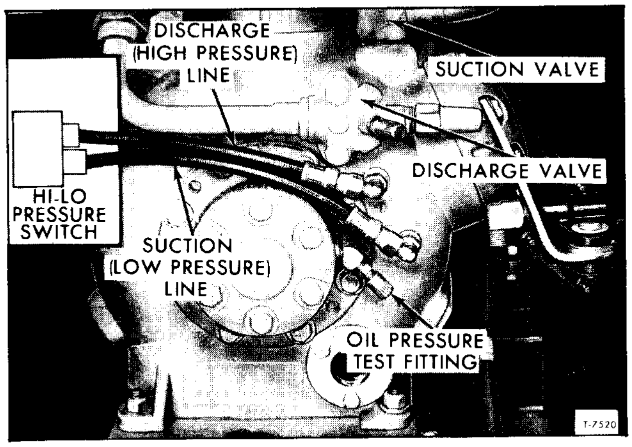

DISCHARGE (HIGH PRESSURE) LINE
SUCTION VALVE
DISCHARGE VALVE
HI-LO PRESSURE SWITCH
SUCTION (LOW PRESSURE) LINE
OIL PRESSURE TEST FITTING
T-7520

Figure 22—Hi-Lo Pressure Switch Line Connections

4. Remove cylinder push rod yoke pin from yoke and clutch release fork. Remove two bolts which attach air cylinder bracket to compressor cylinder head. Remove air cylinder from compressor and replace bolts in cylinder head.
5. Remove cap from suction valve on top of compressor and from discharge valve at rear of compressor. Turn valve stems all the way in (clockwise - closed) to isolate compressor from system.
6. Slowly loosen bolts which attach valves to compressor. Remove valves and tie freon tubes with attached valves clear of compressor.
7. Immediately after removing valves, install closure plates with gaskets over compressor valve openings. Plates shown in figure 21 can be improvised locally.

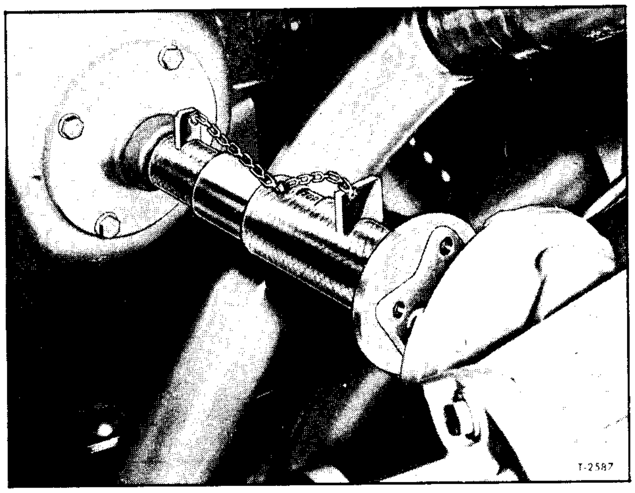


Figure 23—Compressor Alignment Tool Installed (Typical)

8. Disconnect "HI-LO" pressure switch hoses at compressor fittings (fig. 22). Cap connections and tie hoses clear of compressor.
9. Remove bolts which attach upper and lower end of body post to body at rear of compressor. Remove post.
10. Remove four bolts which attach outer and inner rear mounting brackets to compressor.
11. Remove two nuts and bolts which attach compressor to front mounting bracket.
12. Disconnect drive shaft at accessory drive flange and remove driveshaft.
13. Lift compressor and remove from coach with rear mounting brackets attached. Note and record number of shims used at each mount.

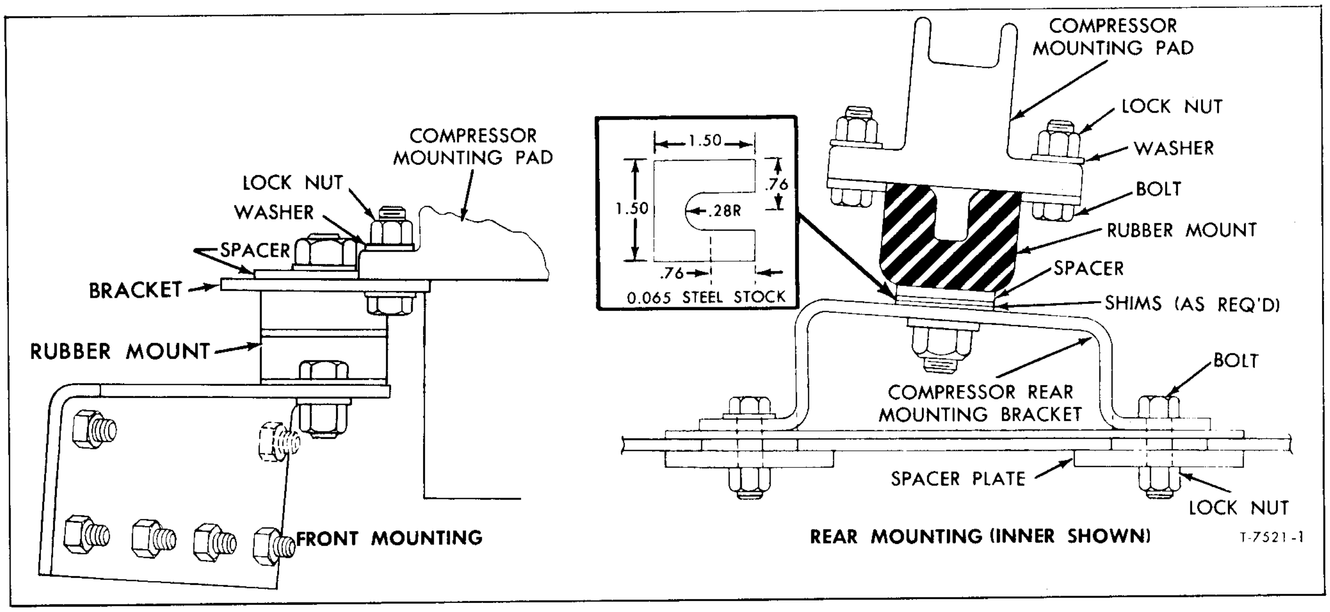
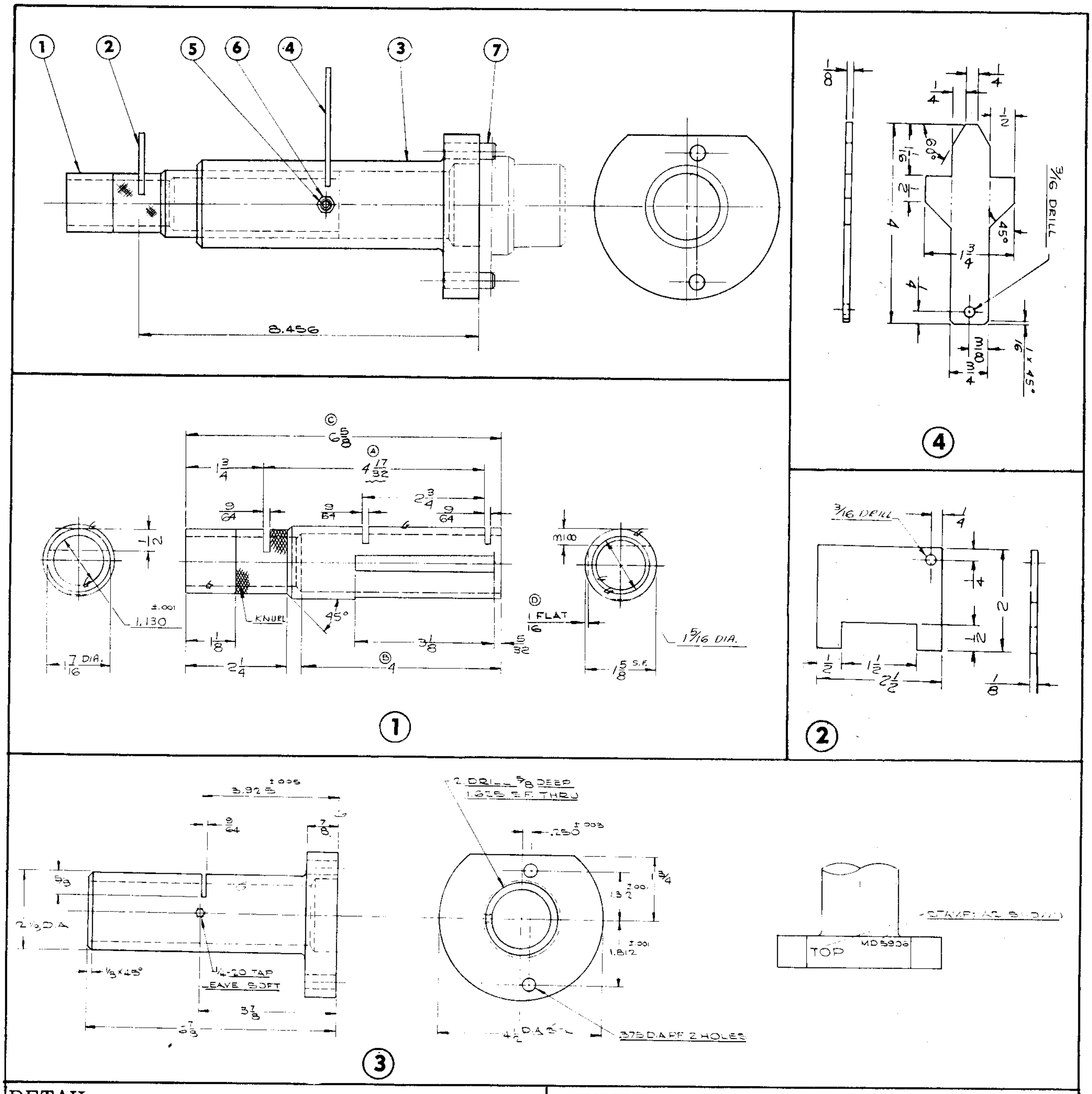


Figure 24—Compressor Mounting and Shim Details (Typical)



DETAIL NO.	QTY.	STOCK SIZE	MATERIAL
1	1	1-5/8 dia. x 6-5/8 lg.	C.R.S.
2	1	1/8 x 2 x 2-5/8	Gauge Stock
3	1	4½" dia. x 6-7/8" lg.	C.R.S.
4	1	1/8 x 1¾ x 4-1/8	Gauge Stock
5	1	¼-20 Dogpoint Setscrew	-
6	1	¼-20 hex nut	Std.
7	2	3/8 dia. x 1-3/8 lg.	C.R.S.

T-7957

Figure 25—Compressor Alignment Tool Details

Support compressor in manner whereby weight is not supported on clutch release fork.

INSTALLATION (Fig. 19)

1. Before installing the compressor, examine compressor rubber mountings. If mounting rubber sections are deteriorated or collapsed, they should be replaced.
2. Attach rubber mounts, shims, and mounting brackets to compressor. See figure 24 for cross section of compressor mountings. Place compressor into compartment.
3. Install four bolts with spacers which attach inner and outer rear brackets to body and hand-tighten with spacers and spacer plates positioned as shown in figure 24, install front mounting bolts, washers, and nuts and hand-tighten.
4. IMPORTANT: Mounting holes in compressor support plates are oversized so compressor can be aligned when installing in coach. An alignment tool (fig. 23) must be used to align compressor properly. Tool can be fabricated locally from dimensions and specifications called out in figure 25.
5. Slip narrow end of tool over clutch spline. Rotate tool so that flat on flange end of tool which is inscribed "TOP" is located at top. Extend flange end until stops (detail 2 and 4, fig. 25) can be inserted.
6. Crank engine until two opposing holes in accessory drive flange are vertical. Insert locating pins on tool into flange.
7. Move compressor toward accessory drive until end of spline rests against stop in tool.
8. Compressor should then be positioned until flange on alignment tool is flat with flange on accessory drive.
9. Alignment of compressor to proper drive angle should generally be accomplished by positioning compressor in oversized mounting holes. However, rear mounting shims may have to be added or removed (fig. 24) if any of the mounting components have been replaced.
10. When compressor is properly aligned, scribe alignment marks along end and side of outer rear mounting bracket. Remove alignment tool, then install drive shaft assembly into clutch spline and attach drive shaft assembly to accessory drive flange.
11. Remove closure plates from ports of compressor. Being careful not to allow dirt to enter ports, attach refrigerant valves to compressor, using new gaskets. Tighten bolts evenly and firmly.
12. Connect lines from "HI-LOW" pressure switch to compressor fittings. Tighten connections firmly.
13. Install clutch control air cylinder by removing two compressor head bolts and attaching bracket. Temporarily apply shop air pressure (65 psi or more) to clutch control air cylinder. Make clutch linkage adjustment and secure release fork to cylinder push rod yoke as directed later under "Compressor Drive Maintenance".
14. Connect clutch control air cylinder air line.
15. Install body post to side of coach. Tighten bolts firmly.
16. Accomplish services outlined later under "Refrigerant Valves," "Purging The System," "Testing For Leaks," and "Checking For Air In The System," all in "SYSTEM SERVICES AND TESTS" section.
18. Install stone shield below compressor.

REFRIGERANT COMPRESSOR OVERHAUL

Before overhauling compressor (fig. 26), the system must be pumped down and the unit removed from the coach. Instructions for pumping down the system are explained later under "SYSTEM SERVICES AND TESTS." Procedures for removing compressor are explained previously under "Compressor Replacement."

IMPORTANT

The immediate area in which the compressor is to be overhauled should be dust-free, and if pieces of cloth are to be used for the cleaning of parts, they should be lint-free.

When servicing parts of compressor, handle the parts carefully and protect them against rusting immediately upon removal from compressor housing. Before installing parts, wash with refrigeration compressor parts cleaner, then oil with new (clean) compressor oil. This applies especially to seal and bearing surfaces to prevent seizure when unit is first put in operation. Use new O-ring seals and gaskets at build-up of compressor.

The design of compressor permits the replacement of many components and subassemblies without having to disassemble balance of compressor. For example, the cylinder liner can be replaced without having to remove piston and rod. However, the overhaul procedures described herein covers disassembly of compressor in logical sequence and to the extent recommended by the manufacturer.

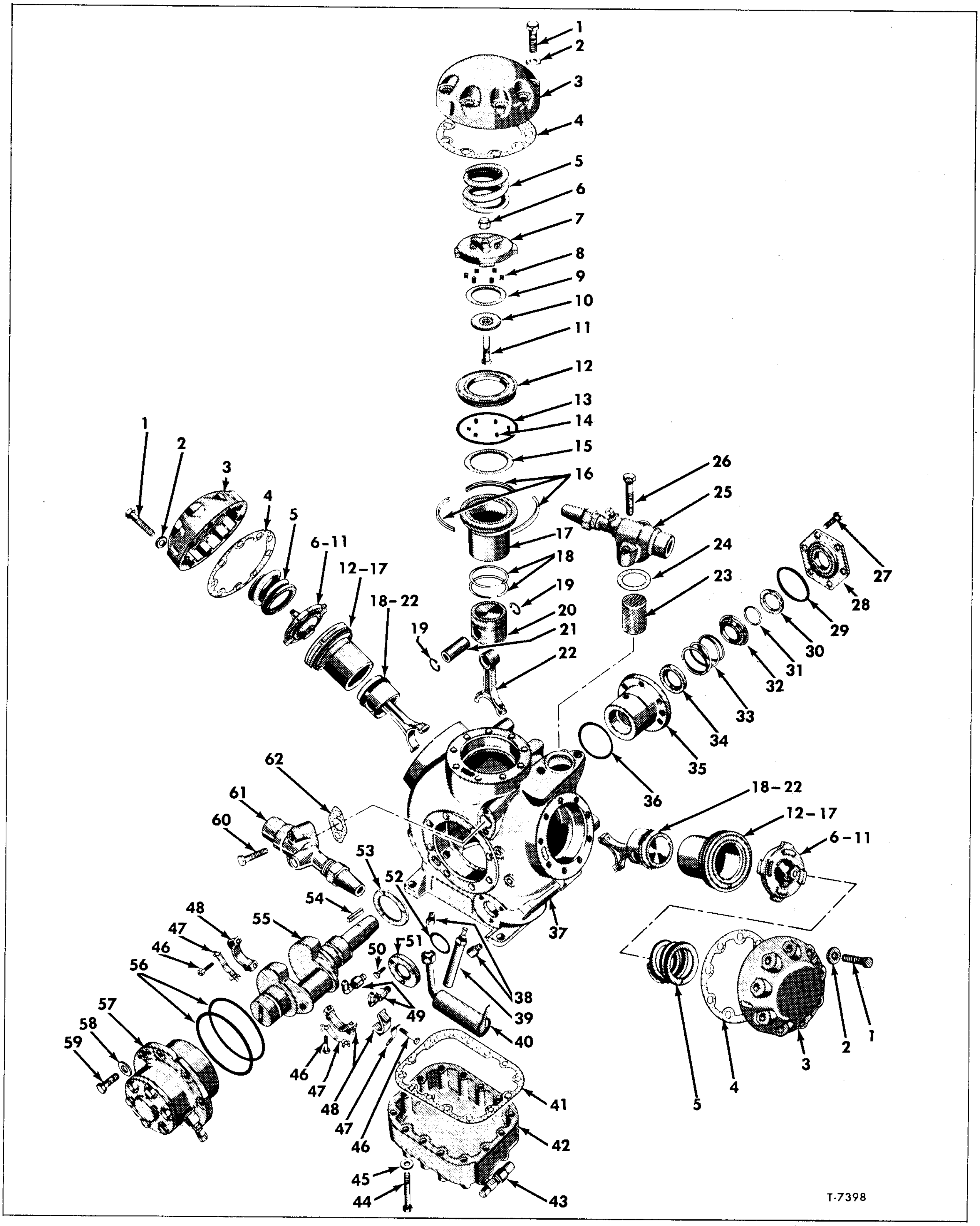


Figure 26—Refrigerant Compressor Components

1 Bolt (3/8"-16 x 1¾")
2 Flat Washer
3 Cylinder Head
4 Gasket
5 Safety Head Spring
6 Nut - Discharge Valve
7 Discharge Valve Cage
8 Discharge Valve Springs
9 Discharge Valve
10 Discharge Valve Seat
11 Discharge Valve Cage Bolt
12 Suction Valve Plate
13 O-Ring
14 Suction Valve Springs
15 Suction Valve
16 Suction Valve Retaining Rings
17 Cylinder Liner
18 Piston Rings
19 Snap Rings
20 Piston
21 Piston Pin
22 Connecting Rod
23 Refrigerant Strainer
24 Gasket
25 Suction Valve Assembly
26 Bolt (½"-13 x 2")
27 Bolt (3/8"-16 x 1¼")
28 Seal Cover
29 Seal O-Ring
30 Carbon Nose Ring
31 Teflon Ring
32 Neoprene Ring, Front Spring Retainer and Clamp Ring
33 Spring
34 Rear Spring Retainer
35 Seal End Bearing
36 O-Ring
37 Compressor Housing
38 Oil Drain Orifice
39 Oil Relief Valve Assembly
40 Oil Strainer Assembly
41 Gasket
42 Handhole Cover
43 Oil Charging Valve
44 Bolt (3/8"-16 x 3")
45 Flat Washer
46 Connecting Rod Cap Bolt
47 Lock Strap
48 Connecting Rod Cap
49 Discharge & Suction Fittings to HI-LO Pressure Switch
50 Bolt (¼"-20 x 5/8")
51 Sight Glass Assembly
52 O-Ring
53 Thrust Bearing
54 Drive Key
55 Crankshaft
56 O-Rings
57 Oil Pump and Bearing Head Assembly
58 Flat Washer
59 Bolt (3/8"-16 x 1")
60 Bolt (5/16"-18 x 2")
61 Discharge Valve Assembly
62 Gasket

Legend for Figure 26

NOTE: When overhauling compressor, refer to "Compressor Wear Rate Table" under "Specifications" at end of this section.

COMPRESSOR DISASSEMBLY

NOTE: Drain oil from compressor crankcase by removing front and rear cap from the oil charging valve on compressor hand-hole cover (43, fig. 26). Turn valve to open position to drain oil from crankcase.

SUCTION DISCHARGE VALVE REMOVAL

NOTE: Key numbers in text refer to figure 26. These two valve assemblies may have been removed previously when compressor was removed from coach. If not, remove as follows:

1. Remove two bolts which attach each refrigerant valve assembly (25 and 61) to compressor. Remove valves and valve gaskets (24 and 62).
2. Remove strainer screen (22) from suction valve port as shown in figure 27.

CYLINDER HEAD AND DISCHARGE VALVE REMOVAL AND DISASSEMBLY

Key numbers in text refer to figure 26.

1. Remove all but two opposed cylinder head attaching bolts. Back off remaining bolts two or three full turns (fig. 28).
2. Examine cylinder head (3) to see if head is following heads of attaching bolts as shown. If not, tap the head with a plastic hammer until head gasket (4) breaks loose.
3. Slowly and alternately remove two remaining cylinder head bolts, then remove head. Lift off safety head spring (5) and remove head gasket (4) (fig. 29).
4. Lift discharge valve assembly from compressor (fig. 29).
5. Remove lock nut (6) from discharge valve

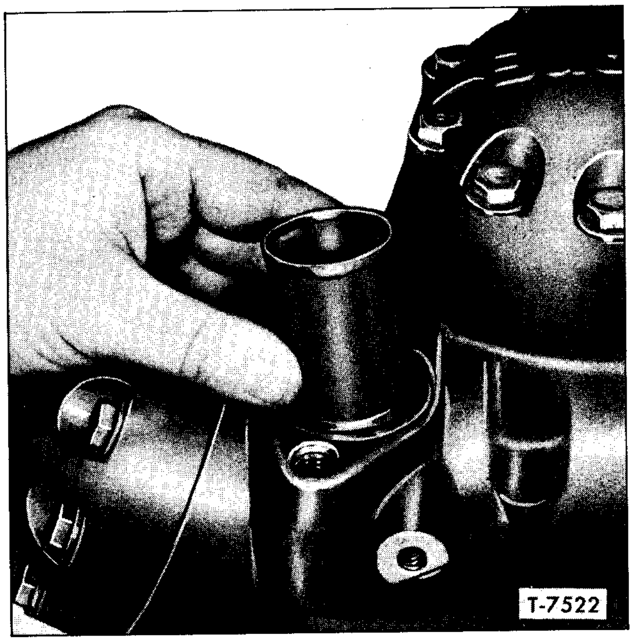


Figure 27—Removing Strainer Screen Assembly

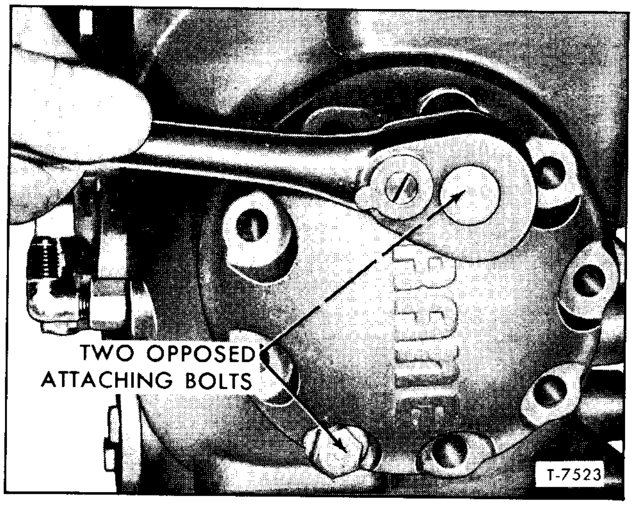


Figure 28—Removing Cylinder Head Cover

bolt (11). Remove bolt and valve seat (10). Separate discharge valve ring (9), and six springs (8) from discharge valve cage (7).

HANDHOLE COVER AND OIL STRAINER REMOVAL

Key numbers in text refer to figure 26.

NOTE: If the cylinder liner only is to be removed, it will not be necessary to remove hand-hole cover (42).

1. Remove cover attaching bolts. If necessary, tap the cover with a soft hammer to loosen. Remove cover and cover gasket (41).

2. Disconnect strainer tube fitting at line. Remove oil strainer (fig. 30).

CYLINDER LINER, PISTON, AND CONNECTING ROD REMOVAL

NOTE: The cylinder liner can be removed from compressor without removing the piston and connecting rod. See following steps 1, 2, and 3: Key numbers in text refer to figure 26.

1. The suction valve plate (12) is tapered inward at the top. A block of wood, plastic, or soft metal should be improvised to dimensions shown in figure 31 to fit into this taper.

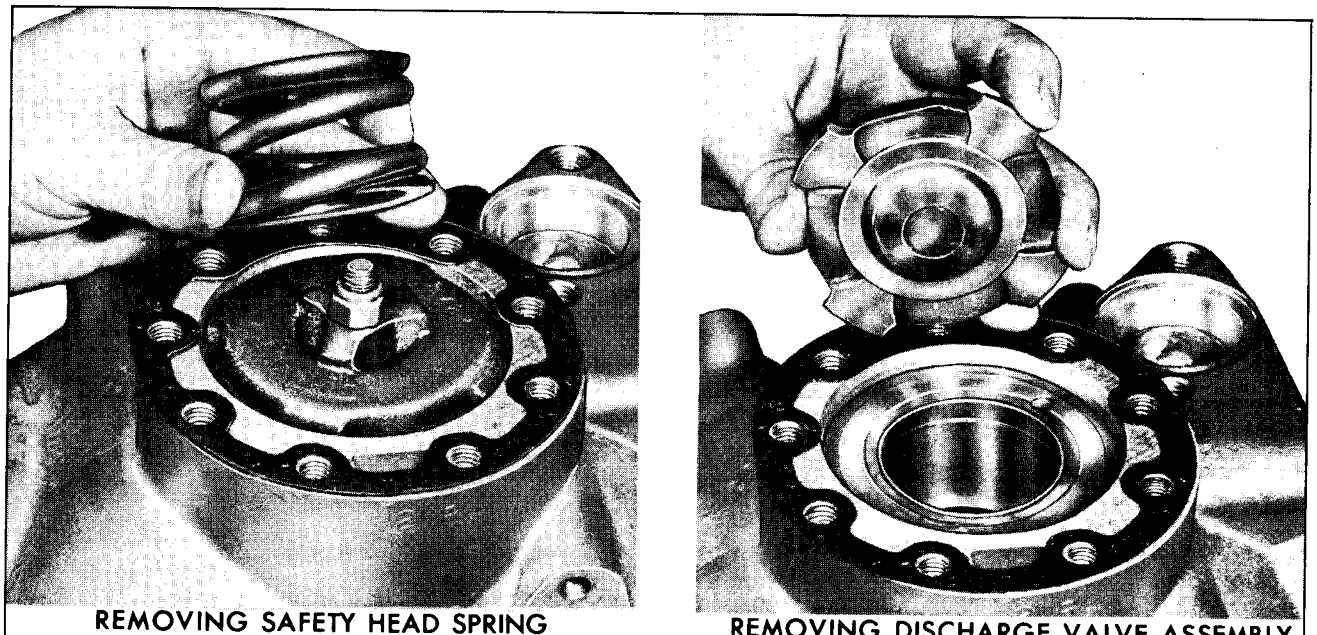
2. Rotate the crankshaft until piston head is down about two inches from top, then place the block into cylinder. Rotate crankshaft to cause piston (20) to press block and cylinder liner (17) from compressor bore (fig. 31).

CAUTION

DO NOT BUMP PISTON AGAINST BLOCK; USE AN EVEN PRESSURE.

NOTE: If piston cannot be used to force liner out, a tapped hole in block (if metal) for the use of a puller bolt can be used to pull liner.

3. Make sure liner is forced out beyond O-ring seal (13), then withdraw liner by hand (fig. 32). Support the piston through the liner so that piston does not bump against the compressor housing when liner separates from piston.


REMOVING SAFETY HEAD SPRING

REMOVING DISCHARGE VALVE ASSEMBLY

Figure 29—Removing Safety Head Spring and Discharge Valve Assembly

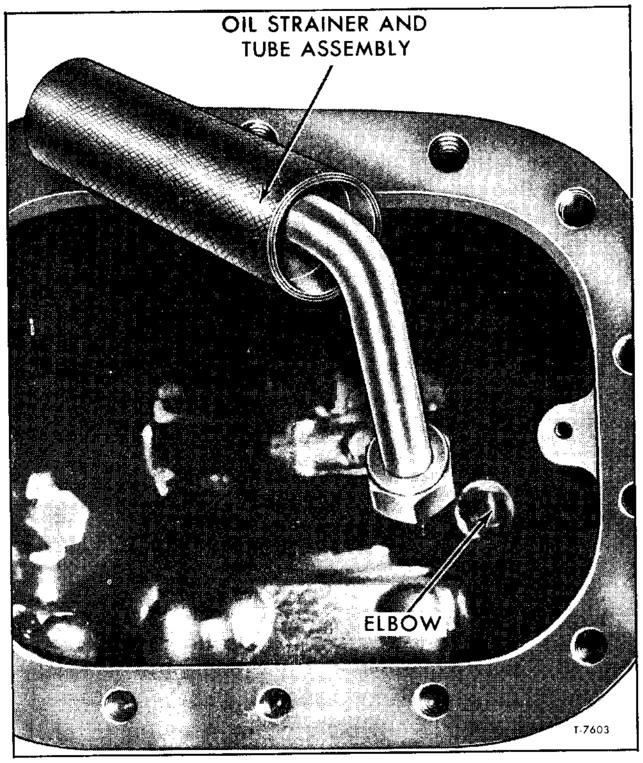


Figure 30—Removing Crankcase Oil Strainer

IMPORTANT: Before removing the two remaining cylinder liner units, the related piston and connecting rod should be removed from the unit. Damage to the piston and piston rings will occur if crankshaft is rotated during removal of remaining liner units.

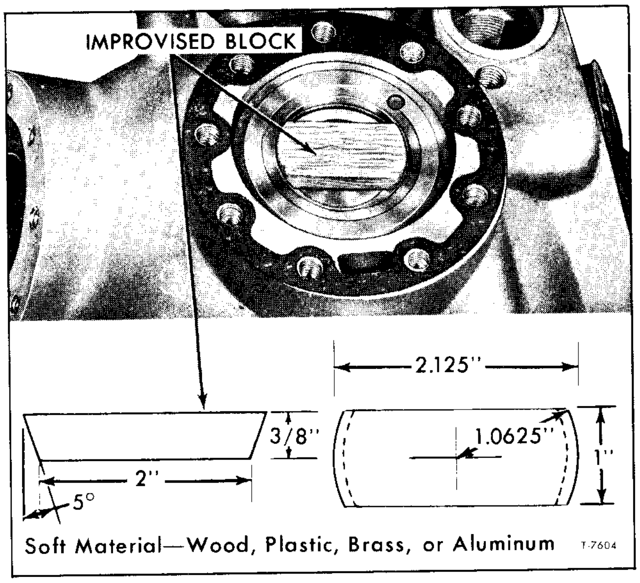


Figure 31—Using Improvised Block to Remove Suction Valve and Liner

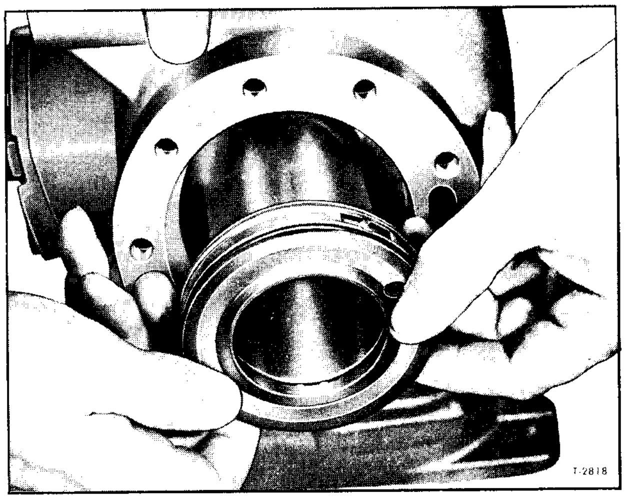


Figure 32—Pulling Liner Off Piston (Typical)

4. To remove liner, piston and connecting rod as a complete assembly, rotate crankshaft (55) until connecting rod cap bolts are accessible through the handhole cover opening. Oil strainer (40) should be removed to prevent damage (fig. 30). Open tabs of connecting rod bolt lock strap (47) as shown in figure 33, then remove cap bolts. Remove the lock strap and cap from bottom of connecting rod. Being very careful, pull liner with piston and rod from the cylinder bore. Pull liner from piston.

IMPORTANT: Keep all liner, piston and rod

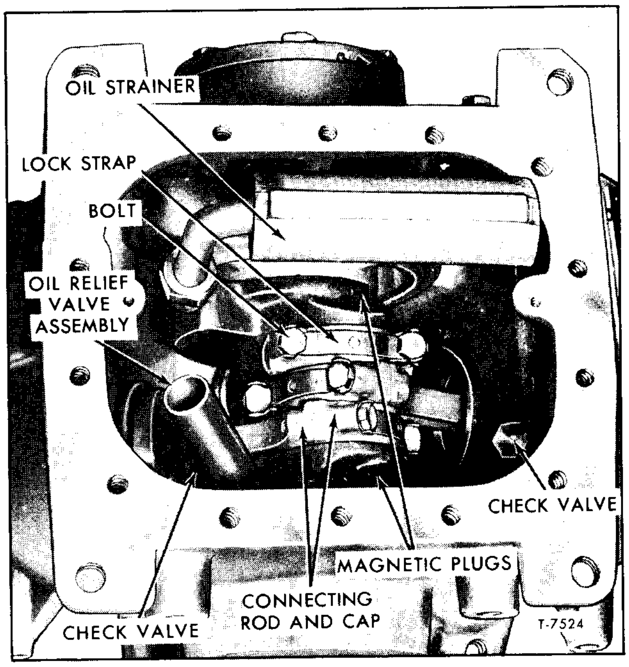


Figure 33—Connecting Rod Cap, Lock Strap, and Bolt Installed

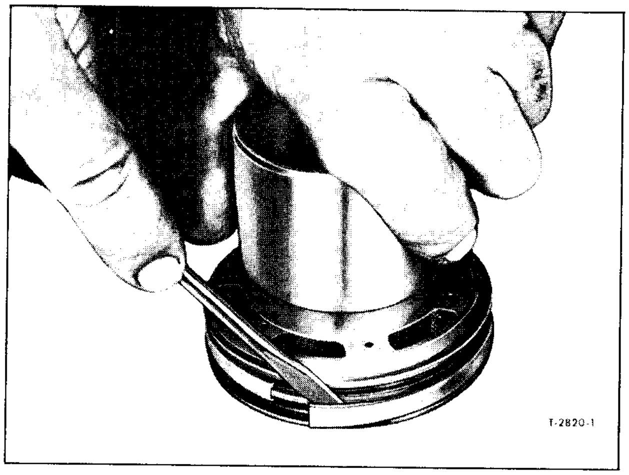


Figure 34—Removing Suction Valve Retaining Rings

assemblies separate and mark them in relation to the bore from which they were removed.

CYLINDER LINER AND SUCTION VALVE DISASSEMBLY

Key numbers in text refer to figure 26.

NOTE: The suction valve assembly is secured to the liner by three 120-degree retainers (16).

1. Invert the liner and valve assembly and pry the retainers outward (fig. 34).

IMPORTANT: DO NOT MOVE THE LINER AROUND ON TOP OF THE VALVE ASSEMBLY.

2. Lift the liner away from the valve assembly and remove the suction valve (15) as shown in figure 35. Remove valve springs (14), and O-ring (13) from valve plate (12).

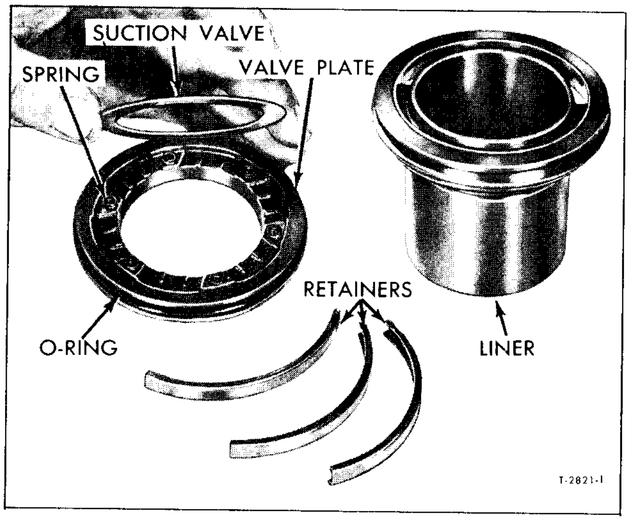


Figure 35—Removing Suction Valve Components

NOTE: Until time of assembly, keep valve plate with related liner as a matched set.

PISTON AND CONNECTING ROD DISASSEMBLY

Key numbers in text refer to figure 26.

1. If rings (18) are to be reused, they can be removed from piston using thin shim stock inserted between rings and piston. Carefully work rings out of groove and slide them over the shim stock and off piston.

2. Using Tru-Arc pliers, remove snap rings (19) from ends of piston pin. Drive pin from piston using a soft driving rod. Use care not to nick piston surface or distort piston pin hole. Figure 36 shows piston and rod components.

COMPRESSOR SHAFT SEAL REMOVAL

Key numbers in text refer to figure 26. Also refer to figure 37.

1. Loosen and remove all but two opposite cap screws (27) which attach seal cover and bearing to housing. Slowly and alternately back out the remaining two cap screws. Seal cover should be forced away from bearing by tension of shaft seal spring (fig. 37). However, if cover does not follow the two cap screws, tap rim of cover lightly with a plastic hammer to free cover from bearing. Carefully back out the two cap screws.

IMPORTANT: Be sure that cover is removed evenly so as not to distort seal and cause breakage of carbon nose ring within seal.

2. When the seal cover has been removed, the seal components (carbon nose ring, teflon ring, neoprene ring, front spring retainer, clamp ring, spring, and rear spring retainer) can usually be pulled from the crankshaft. In some cases, the neoprene ring will adhere to the shaft. It can be loosened by using a seal puller or by hooking short ends of two Allen-type wrenches behind ring and pulling ring from shaft.

IMPORTANT: Use care in handling seal components. The carbon nose ring can be easily broken.

SEAL END BEARING REMOVAL

Key numbers in text refer to figure 26.

1. Remove compressor shaft seal as explained previously under "Compressor Shaft Seal Removed."

2. Thread two puller screws into tapped holes in bearing head flange (fig. 38). Tighten screws evenly to force bearing (35) out of compressor housing.

3. Remove O-ring (36) from bearing.

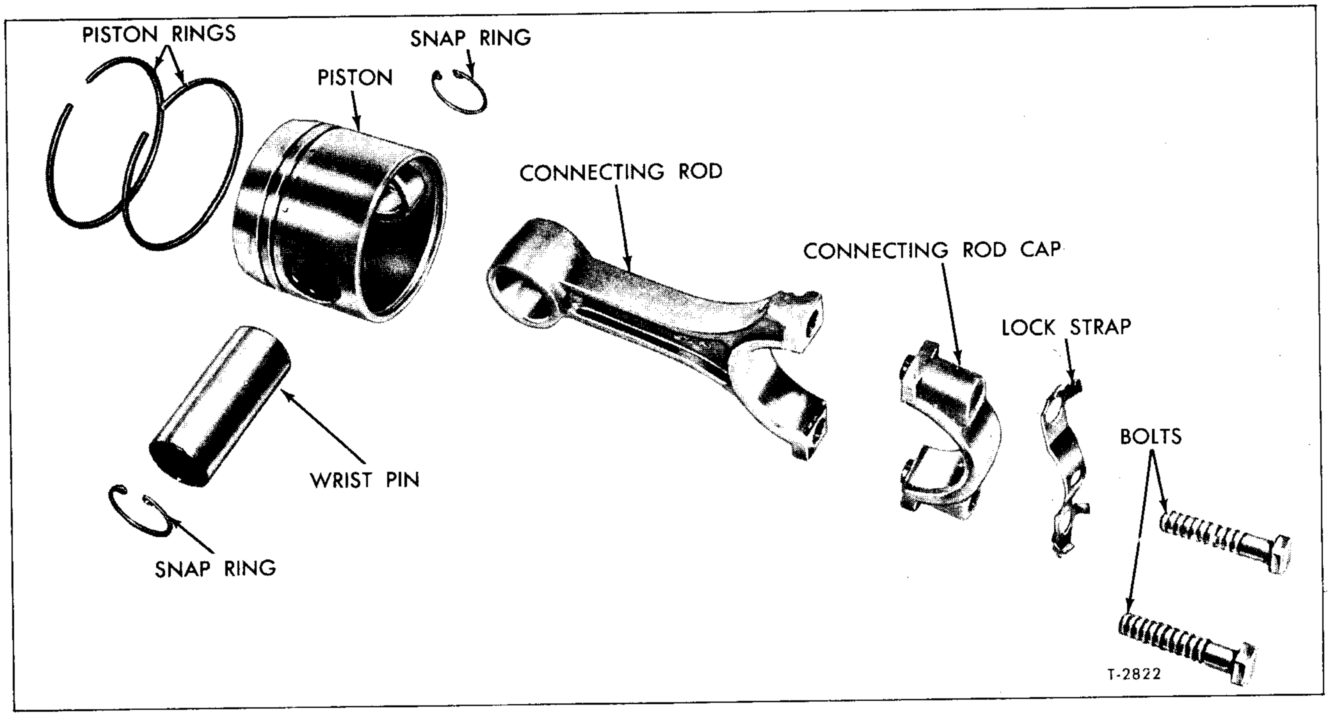


Figure 36—Piston and Connecting Rod Components

PUMP END BEARING AND
OIL PUMP REMOVAL

Key numbers in text refer to figure 26.

1. Remove screws and washers which attach oil pump and bearing head (57) to housing.

2. Thread two puller screws into tapped holes in bearing head flange (fig. 39). Support the crankshaft through handhole cover opening, then tighten puller screws evenly to force oil pump and bearing head assembly from compressor housing.

3. Remove O-rings (56) from bearing and compressor housing.

4. The crankshaft (55) is removed through the bearing head opening. Grip the crankshaft at the end and through the handhole opening slide the crankshaft out of housing (fig. 40).

HOUSING OIL RELIEF VALVE
AND DRAIN ORIFICE REMOVAL

NOTE: Valves are shown installed in figure 33.

1. Remove two oil drain orifices (38, fig. 26) within the housing.

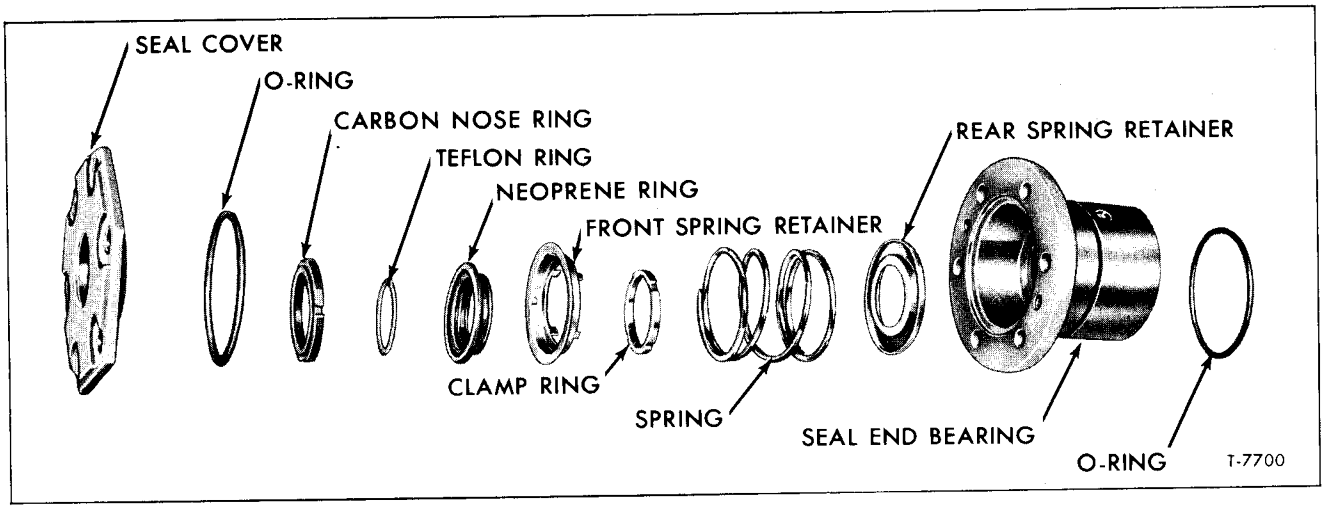


Figure 37—Shaft Seal Components

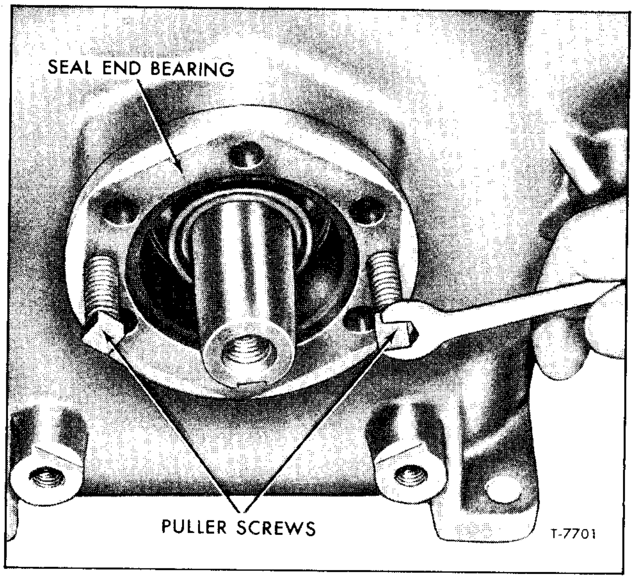


Figure 38—Removing Seal End Bearing

2. Remove the oil relief valve (39, fig. 26) from housing.

NOTE: Clean and replace valves as necessary.

CLEANING AND INSPECTION

CLEANING

1. Clean all compressor components with refrigeration compressor parts cleaner. DO NOT USE CARBON TETRACHLORIDE. Use a stiff bristle brush if necessary to loosen foreign particles. Direct air through all passages in castings and into both ends of all check and relief valves.

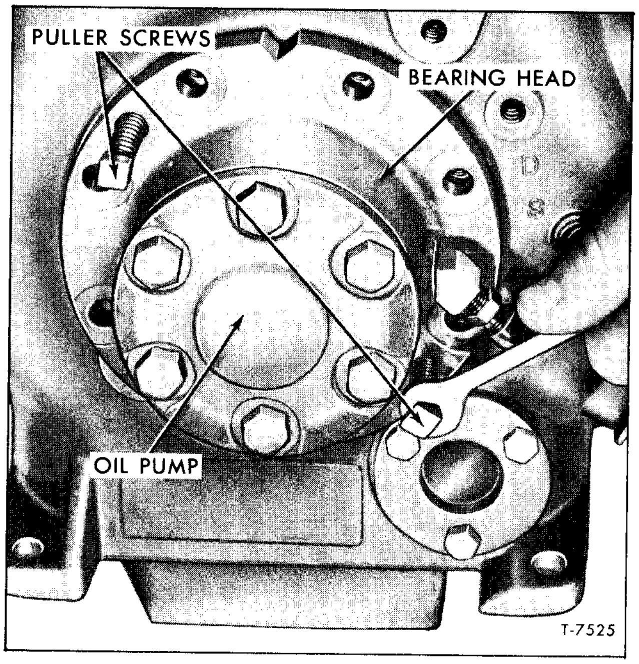


Figure 39—Removing Pump End Bearing and Oil Pump

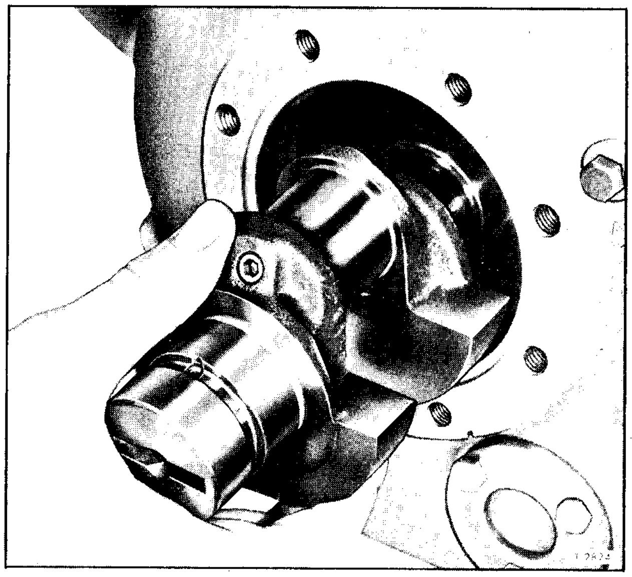


Figure 40—Replacing Crankshaft

2. Scrape all gasket flange surfaces to make sure all gasket and sealing material is removed.

CAUTION

DO NOT GOUGE FLANGE SURFACES WHILE SCRAPING.

INSPECTION

Key numbers in text refer to figure 26.

1. Inspect compressor housing (37) and other tapped components for crossed threads and any other damage.
2. Examine valve surfaces of cylinder suction and discharge valve components. Replace small valve springs (8 and 14) if compressor has operated more than 3,000 hours.
3. Inspect pistons (20) for scoring, cracks, or damage of any kind.
4. Check fit of rings (18) in piston ring grooves. Use back edge of ring to check fit (fig. 41). Rings should move freely in piston grooves.
5. Examine crankshaft seal components for excessive wear or damage. If components are found in good condition they can be reused. If damaged, replace with complete new seal assembly (fig. 37).
6. Check components of compressor for wear to dimensions shown on "Compressor Wear Rate Table" at the end of this section.
7. Examine the crankshaft journals, bearing

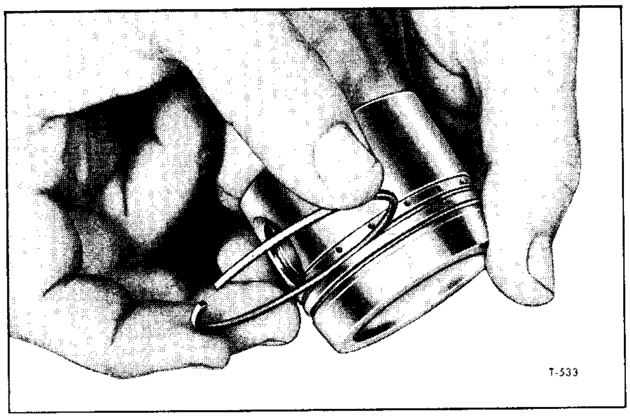


Figure 41—Checking Piston Ring Groove Clearance

surfaces and seal end bearing (35) for wear. Remove plugs from crankshaft. Clean plugs, blow out passages in crankshaft, then replace plugs.

COMPRESSOR BUILD-UP

Before building up compressor, coat all components, except new seal assembly, with clean compressor oil. This will provide initial lubrication and prevent rusting.

IMPORTANT

Use new O-ring seals and gaskets when assembling compressor.

HOUSING OIL RELIEF VALVE AND CHECK VALVE INSTALLATION

Key numbers in text refer to figure 26.

Referring to figure 33, install oil relief valve (39) and two oil drain orifices (38) as shown. Tighten valves firmly.

CRANKSHAFT AND BEARING INSTALLATION

Key numbers in text refer to figure 26.

1. Install new O-ring (36) in groove in seal end bearing (35).
2. Position bearing in opening in compressor housing then use a soft hammer to start bearing into housing. Install two screws at opposite sides of bearing head and tighten evenly to draw bearing into housing.
3. Place thrust bearing (53) on tapered end of crankshaft, then guide crankshaft (55) into housing and into end bearing (35). Reach through handhole opening to support crankshaft.
4. Install the pump end bearing and oil pump (57) and check crankshaft end play with a feeler gauge or dial indicator.

IMPORTANT: Be sure to torque the bearing head attaching screws to 20 foot-pounds to obtain the correct end play reading. End play should be between 0.008" and 0.022". If end play exceeds 0.022", install shim (2497903) 0.015" between shoulder of front main bearing and housing. Figure 42 shows procedure using dial indicator. Move crankshaft endwise when making check.

NOTE: If a feeler gauge is used, measure the clearance between the shoulders of crankshaft and both end bearings. When using this method, measure around the crankshaft at several points to account for any burrs which may be present.

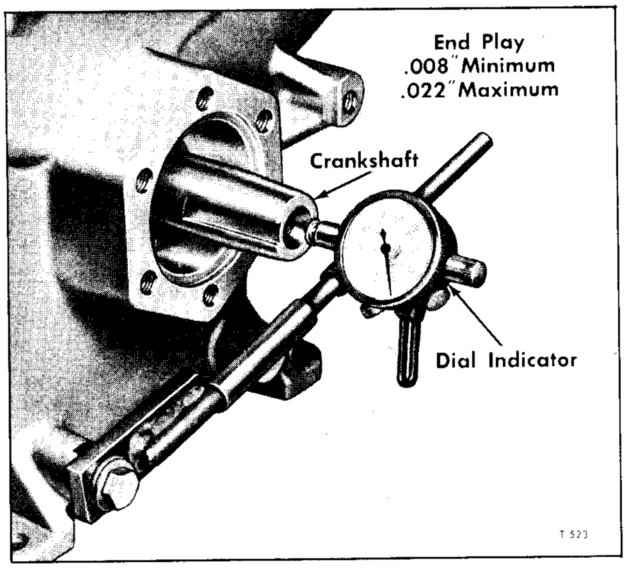


Figure 42—Checking Crankshaft End Play (Typical)

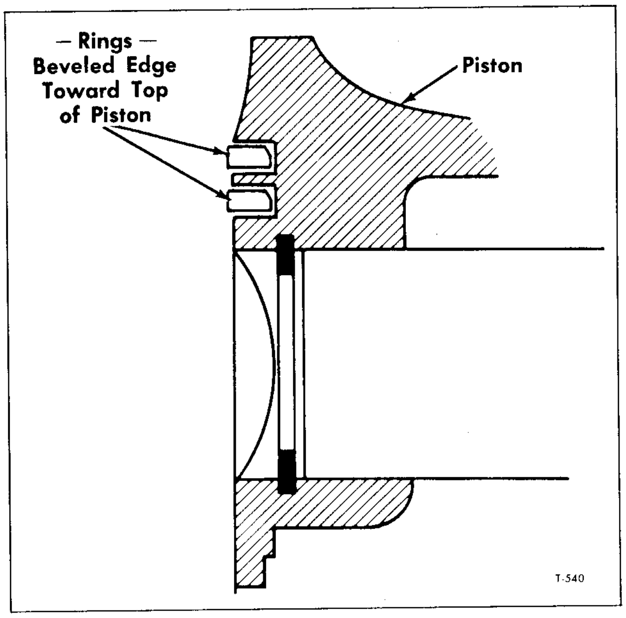


Figure 43—Ring Position in Piston

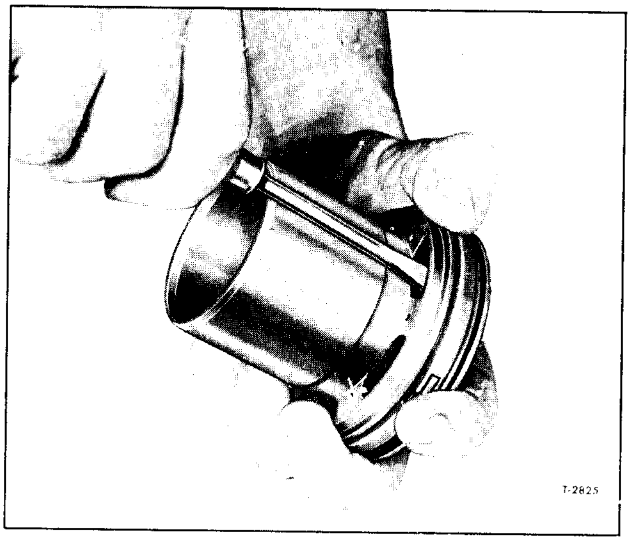


Figure 44—Checking Suction Valve Movement

PUMP END BEARING HEAD AND OIL PUMP INSTALLATION (See Fig. 26 For Key Numbers)

NOTE: Replace oil pump and bearing head assembly if shaft end play exceeds 0.002".

1. Clean and lubricate the bearing surfaces of the crankshaft and bearing head (57).

2. Insert one O-ring (56) into groove of compressor housing and the other O-ring (56) on the bearing head next to the flange.

3. Push oil pump and bearing head into the housing, then rotate head until oil pump key aligns with slot in end of crankshaft. Locate "TOP" stamped on bearing head in position and install attaching bolts. Tighten bolts to 20 ft.-lbs.

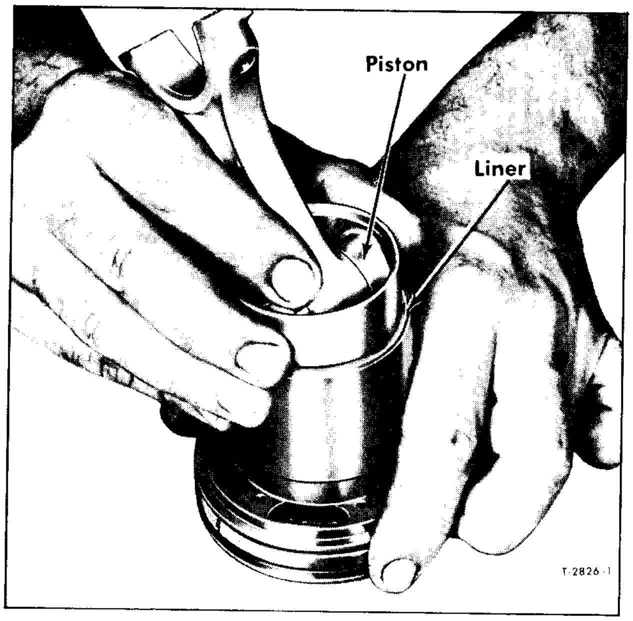


Figure 45—Installing Piston Assembly in Liner

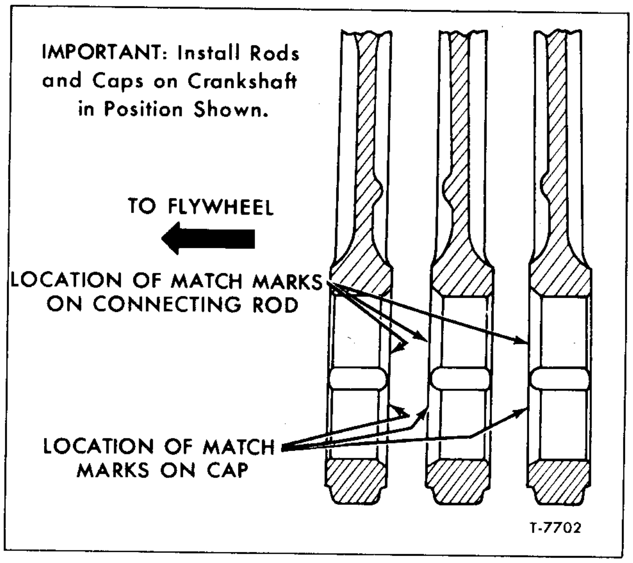

IMPORTANT: Install Rods and Caps on Crankshaft in Position Shown.
TO FLYWHEEL
LOCATION OF MATCH MARKS ON CONNECTING ROD
LOCATION OF MATCH MARKS ON CAP
T-7702

Figure 46—Matching Connecting Rods

COMPRESSOR SHAFT SEAL INSTALLATION

NOTE: Refer to figure 37 when installing seal components.

1. Lubricate seal surfaces of crankshaft with clean compressor oil.

2. Slide rear spring retainer and spring onto end of crankshaft.

3. Assemble front spring retainer, clamp ring, neoprene ring and teflon ring, then wet carbon nose ring with clean compressor oil and fit into spring retainer ring.

NOTE: The notches on the carbon nose ring must be aligned with tabs on retaining ring.

4. Clean face of seal cover and bearing flange where seal cover mounts. Place seal cover with its O-ring against bearing flange. Push in on seal cover, then insert two bolts on opposite sides of cover and tighten hand-tight. Insert the remaining attaching bolts. Tighten bolts evenly to 20 foot-pounds torque.

ASSEMBLY OF PISTON, RINGS, AND CONNECTING ROD

Key numbers in text refer to figure 26.

1. Position connecting rod (22) in piston (20). Drive piston pin through piston and rod using a hammer and soft driver. Install pin snap rings (19) using Tru-Arc pliers.

2. Work rings (18) carefully over top of piston to their respective grooves, using shim stock to aid in moving rings into position.

NOTE: Chamfer on rings should always be on top as shown in figure 43. Check for freeness of rings in grooves after installing.

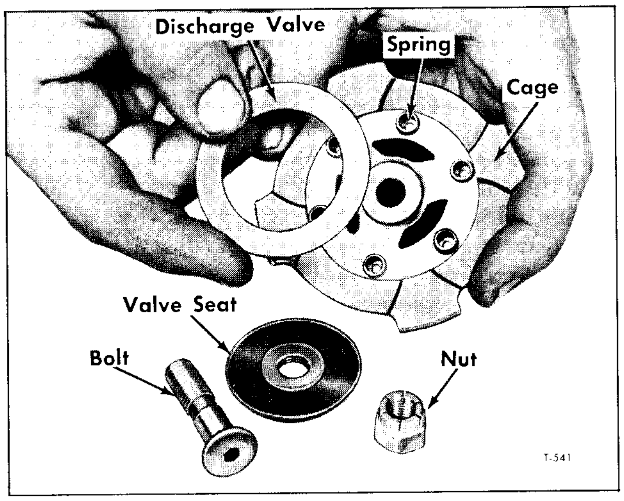


Figure 47—Installing Discharge Valve Components

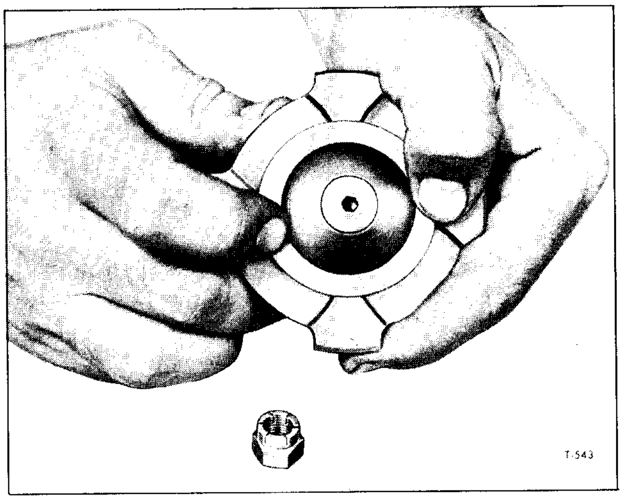


Figure 48—Checking Discharge Valve Movement

ASSEMBLY OF SUCTION VALVE AND LINER

Key numbers in text refer to figure 26.

1. Place the O-ring (13) into outer groove of valve plate (12). Figure 35 shows O-ring installed.
2. Place six small valve springs (14) into position in valve plate, then place suction valve (15) over springs as shown in figure 35.
3. Set the liner down over the suction valve assembly and install the three 120-degree retainers (16).
4. Work the suction valve (15) to make sure it is not restricted or pinched within the assembly (fig. 44).

INSTALLATION OF CONNECTING ROD, PISTON, AND LINER

NOTE: Clean the bearing surfaces of the connecting rod, rod cap, and the crankshaft, then lubricate with clean compressor oil.

1. Invert the cylinder liner and suction valve assembly on a soft surface. Stagger the piston ring gaps.
2. Work the piston head and rings down into the liner with a rocking motion (fig. 45).

NOTE: The inside edge of liner skirt is tapered to assist the entry of piston and rings.

3. After both rings have entered the liner, push the piston down until top of piston is even with top of suction valve plate.

NOTE: To match and install connecting rod and cap properly, refer to figure 46.

4. Rotate the crankshaft until the journal is in position below the cylinder opening. Guide the rod by reaching through the handhole cover opening. Make sure the rod seats properly on the crankshaft.
5. Press the liner and suction valve assembly all the way into cylinder opening, then place the rod cap in position (chamfer to fillet) and install rod bolts and a NEW lockstrap (47). Tighten bolts to 5 foot-pounds torque, then bend up tabs of lockstrap against heads of bolts.

IMPORTANT: After tightening rod bolts, rotate the crankshaft to be sure the rod is free. Repeat as each rod is installed.

CAUTION: Overtightening of bolts will distort cap.

ASSEMBLY OF DISCHARGE VALVE COMPONENTS

Key numbers in text refer to figure 26.

Figure 47 shows valve components being installed.

1. Place the valve springs (8) into valve cage (7) and lay the valve ring (9) over the top of the springs. Insert the valve seat (10) and bolt (11).
2. Work the valve ring up and down to make sure it is free to move as shown in figure 48.
3. Attach lock nut (16) and tighten to 28 foot-pounds torque.

DISCHARGE VALVE AND CYLINDER HEAD INSTALLATION

Key numbers in text refer to figure 26.

1. Place the discharge valve assembly over piston (fig. 29).
2. Center the safety head spring (5) on the discharge valve assembly as shown in figure 29.
3. Insert two bolts (1) with washers on opposite sides of cylinder head (3). Apply clean compressor oil to head gasket (4) then place gasket on the head using bolts as a guide.

4. Place the head, with two bolts and washers, over the cylinder and start bolts (two or three turns). Inspect the safety head spring (5) to be sure it is positioned properly.

5. Tighten both head bolts alternately to draw the head down evenly. Insert remaining bolts and washers. Tighten bolts to 20 foot-pounds torque.

OIL STRAINER INSTALLATION

Position oil strainer in compressor housing as shown in figure 33. Connect the strainer tube and tighten connection firmly.

HANDHOLE COVER UNIT ASSEMBLY AND INSTALLATION

Key numbers in text refer to figure 26.

Apply clean compressor oil to handhole cover gasket (41), the install gasket and handhole cover (42) to housing. Install attaching bolts (44) finger-tight, then tighten bolts evenly to 20 foot-pounds torque.

REFRIGERANT STRAINER SCREEN, SUCTION, AND DISCHARGE VALVE INSTALLATION

Key numbers in text refer to figure 26.

1. Insert oil strainer screen assembly (23) down into suction valve port (fig. 27).

2. Using new valve gaskets (24 and 62), install bolts attaching suction and discharge valves. Tighten discharge valve bolts to 20 foot-pounds torque and the suction valve bolts to 45 foot-pounds torque.

COMPRESSOR DRIVE

Compressor, mounted in coach as shown in figures 19 and 49, is driven through an air-operated disc clutch which is mounted to drive end of compressor. Clutch is propeller shaft driven from accessory drive unit mounted to front end of coach engine.

Clutch is engaged by air pressure admitted through an electrically-operated air valve (fig. 9). Air pressure from solenoid valve to the clutch air cylinder is supplied through a flexible air line.

When air pressure is applied to clutch cylinder the clutch is engaged. When air pressure is exhausted from cylinder, clutch becomes disengaged. Spring within clutch removes the pressure from clutch plate.

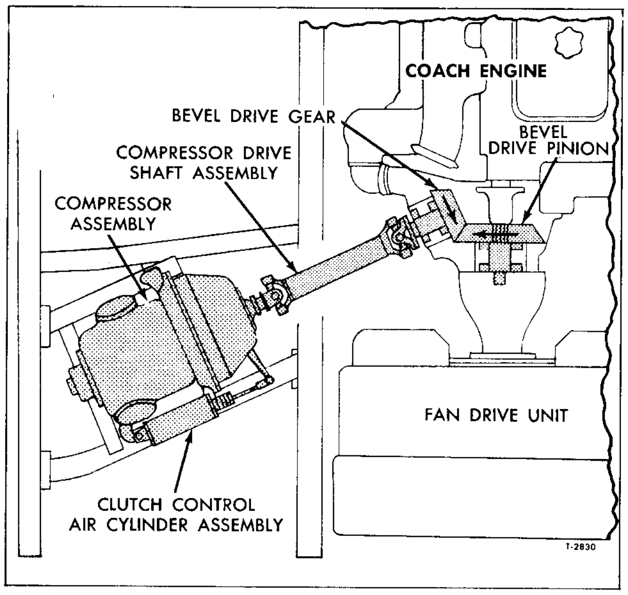


Figure 49—Compressor Drive Shaft and Accessory Drive Layout (Typical)

Procedures for removing and overhauling the clutch assembly are explained later under "Compressor Drive Clutch." Overhaul procedure of clutch assembly is also explained later under "Compressor Drive Clutch."

COMPRESSOR DRIVE OPERATION

With "HEAT-AIR COND." switch on control panel at left of driver placed in "AIR COND." position, and with the engine oil pressure being less than 25 psi and the pressure in coach air system at 65 psi or more, the clutch control solenoid valve becomes energized. With solenoid valve operating coil energized, air pressure is admitted to clutch air cylinder through the flexible line which releases pressure from clutch cover spring, causing clutch to become engaged. Lower view of figure 53 shows clutch in the engaged position, air pressure applied. The upper view of figure 53 shows disassembled components of clutch.

Refer to applicable "Heating and Air Conditioning Wiring Diagram" in "Wiring Diagrams" booklet X-7014A for electrical circuits.

COMPRESSOR DRIVE MAINTENANCE

The following instructions apply to items which require periodic inspection and adjustment. Maintenance information on compressor drive propeller shaft, accessory drive clutch, and clutch control air cylinder is explained later under respective headings.

Inspect clutch drive components, making sure clutch housing bolts and drive shaft universal joint flange bolts and nuts are tight.

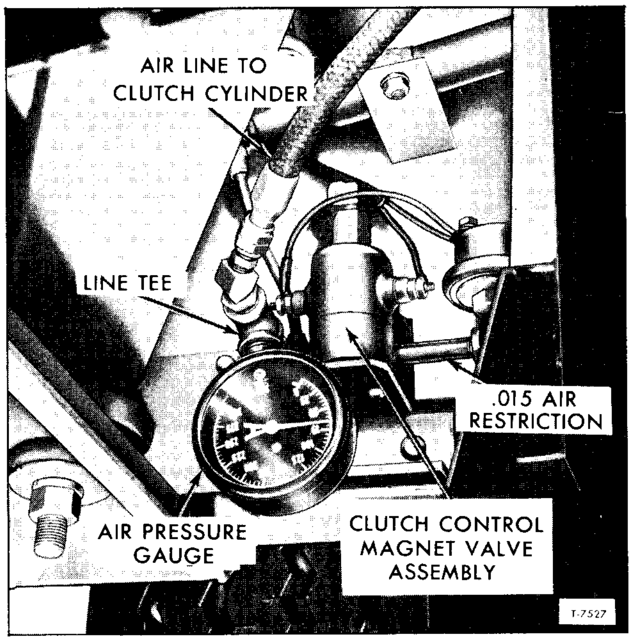

AIR LINE TO CLUTCH CYLINDER
LINE TEE
.015 AIR RESTRICTION
AIR PRESSURE GAUGE
CLUTCH CONTROL MAGNET VALVE ASSEMBLY
T-7527

Figure 50—Clutch Control Air Pressure Check (Typical)

CLUTCH CONTROL AIR PRESSURE CHECK

In manner shown in figure 50, check the air pressure to clutch control cylinder. Disconnect air line between solenoid valve and air cylinder, and install a test air pressure gauge as shown. Deplete pressure in coach air system down to 40 to 50 pounds or even less. While observing test gauge have assistant start engine and place air conditioning control to operating position. Note pressure on gauge at time solenoid valve releases air pressure to test gauge. Solenoid valve should be energized (opened) by the air pressure switch at 65 ± 3 pounds. If this does not occur, replace air pressure switch (fig. 50), then recheck.

LUBRICATION

After each three months of operation, two small square head plugs should be removed from end covers of clutch control air cylinder and 1/2 oz. of S.A.E. 10W engine oil injected into cylinder. Replace plugs firmly after adding lubricant.

At regular chassis lubrication intervals, apply Non-Melting Grease, No. 2 Grade with extreme pressure properties to fitting at each joint of compressor drive shaft assembly and to fitting on shaft slip yoke.

At regular chassis lubrication intervals, the clutch release bearing surface of the main bearing retainer, item 10, in figure 53, should be lubricated with S.A.E. 30 oil using a pressure oiler. Also, lubricate pin at each end of clutch air cylinder using grease containing zinc oxide.

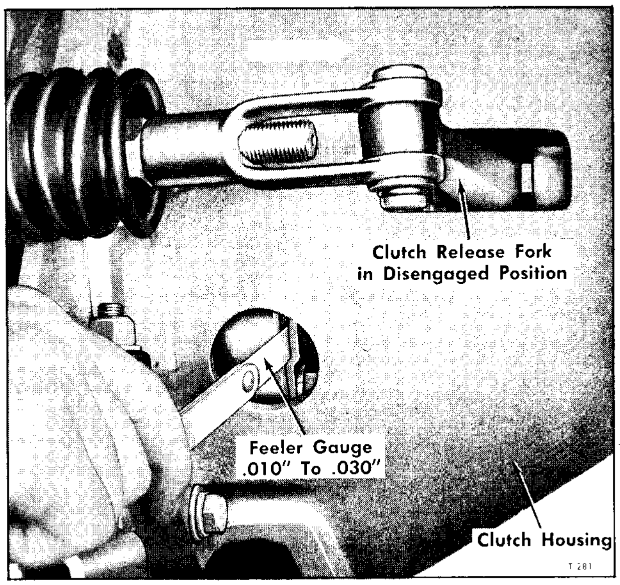

Clutch Release Fork in Disengaged Position
Feeler Gauge .010" To .030"
Clutch Housing
T 281

Figure 51—Checking Clutch Drive Plate Clearance

Clutch release bearing is accessible through opening at top of compressor clutch housing.

COMPRESSOR CLUTCH RELEASE FORK ADJUSTMENT

At regular intervals the overall clearance between the clutch driven plate, the pressure plate, and the compressor flywheel (dimension "C," fig. 53) should be checked. Clearance should measure 0.010" to 0.030". This is accomplished as follows: With clutch disengaged, air cylinder push rod extended, measure plate clearance through hole in bottom of clutch housing and one of the holes in pressure plate cover (fig. 51). Clutch cover must be rotated so that holes will line up to insert feeler. If clearance is not as specified, make adjustment as follows:

With clutch cylinder push rod in the retracted position, air pressure applied, and with release

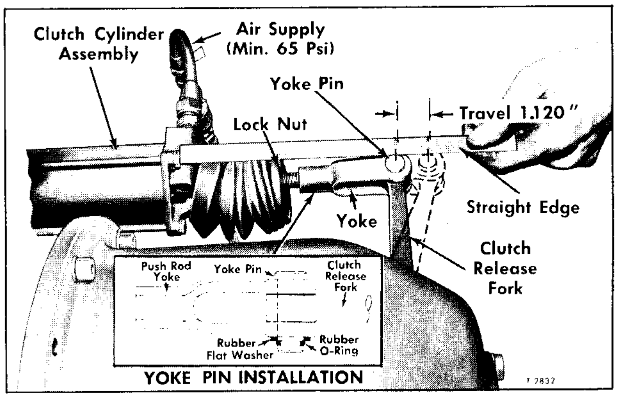
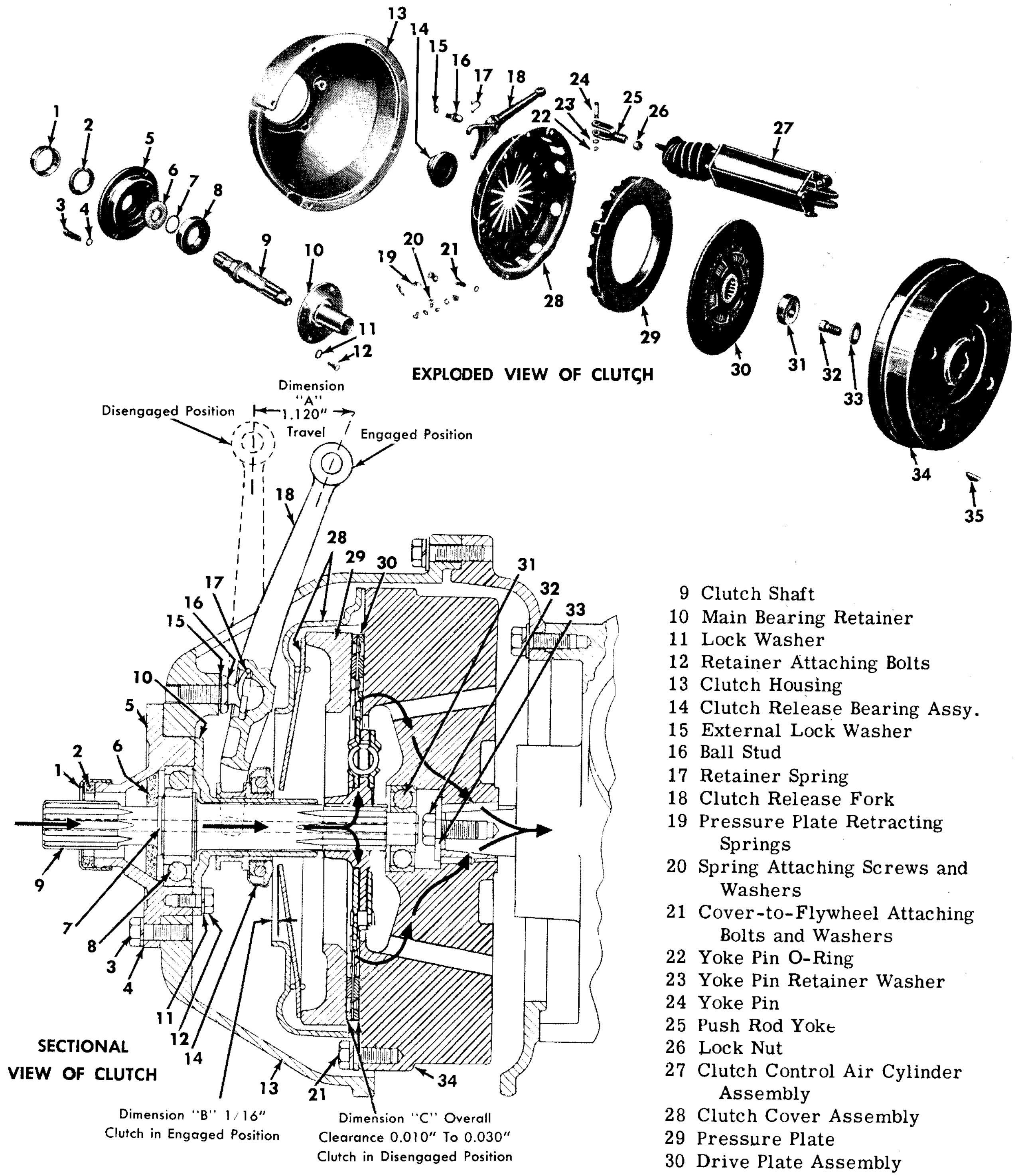


Figure 52—Piston Rod Yoke Adjustment

AIR COND.—MODEL PD-4905



Dimension "A" 1.120" Travel

Disengaged Position

Engaged Position

Dimension "B" 1/16" Clutch in Engaged Position

Dimension "C" Overall Clearance 0.010" To 0.030" Clutch in Disengaged Position

1 Cork Seal Retainer Cap
2 Cork Seal
3 Carrier Attaching Bolt
4 Lock Washer
5 Main Bearing Carrier
6 Felt
7 Bearing Retainer Ring
8 Main Bearing Assembly
9 Clutch Shaft
10 Main Bearing Retainer
11 Lock Washer
12 Retainer Attaching Bolts
13 Clutch Housing
14 Clutch Release Bearing Assy.
15 External Lock Washer
16 Ball Stud
17 Retainer Spring
18 Clutch Release Fork
19 Pressure Plate Retracting Springs
20 Spring Attaching Screws and Washers
21 Cover-to-Flywheel Attaching Bolts and Washers
22 Yoke Pin O-Ring
23 Yoke Pin Retainer Washer
24 Yoke Pin
25 Push Rod Yoke
26 Lock Nut
27 Clutch Control Air Cylinder Assembly
28 Clutch Cover Assembly
29 Pressure Plate
30 Drive Plate Assembly
31 Pilot Bearing Assembly
32 Flywheel Bolt
33 Flat Washer
34 Flywheel
35 Flywheel Drive Key

T-7556-1

Figure 53—Compressor Drive Clutch Components (Typical)

bearing resting against the Belleville spring, locate yoke on push rod so that hole in clutch release fork is about two-thirds of a hole out of line with hole in yoke, the hole in fork being further away from the air cylinder. Swing release fork so that its hole will line up with yoke hole and insert pin. Extend push rod by shutting off air supply to air cylinder. Push rod should move out a minimum of 1.120 inches (fig. 52). Measure plate clearance through hole in bottom of clutch housing. If clearance is not enough, thread yoke further out to push rod and vice versa.

With clutch in the engaged position (air pressure applied), release bearing should clear the Belleville spring by at least 1/16-inch (dimension "B," fig. 53). If there is less than 1/16-inch it means that more stroke is being applied to spring than is necessary to get 0.010-0.030 inch plate clearance. Distance of release bearing from Belleville spring can be checked by removing pin through yoke and release fork and swinging bearing against spring by hand. Then, gradually move bearing away from spring, observing distance the outer end of release fork travels. A 7/64 inch movement at outer end is equal to 1/16 inch at the inner end. After correct adjustment is obtained, lock jam nut against yoke and place rubber holding washer and O-ring on end of pin (see inset, fig. 52).

COMPRESSOR DRIVE PROPELLER SHAFT

The compressor drive propeller shaft is of torsional-type for the purpose of dampening out engine torsionals during normal operation of compressor.

Fixed-yoke end of shaft is flange-bolted to the engine accessory drive and the opposite end of shaft is slip-yoke mounted to compressor clutch shaft which is splined. Shaft universal joint bearings are of needle-type and can be readily replaced as directed later under "Universal Joint Bearing Replacement." To avoid early failure of joint bearings and other drive line components, it is necessary that the compressor and propeller shaft be aligned properly. Instructions for making check and alignment are explained earlier under "Compressor Installation."

Propeller shaft assembly is equipped with three lubrication fittings, one at each joint, and one at the splined yoke on clutch drive shaft.

IMPORTANT: Use a hand gun when lubricating the slip-yoke fitting, as over-lubricating may force lubricant into the clutch disc and cover area. Lubricate all three fittings with SPECIAL lubricant specified in LUBRICATION (SEC. 13).

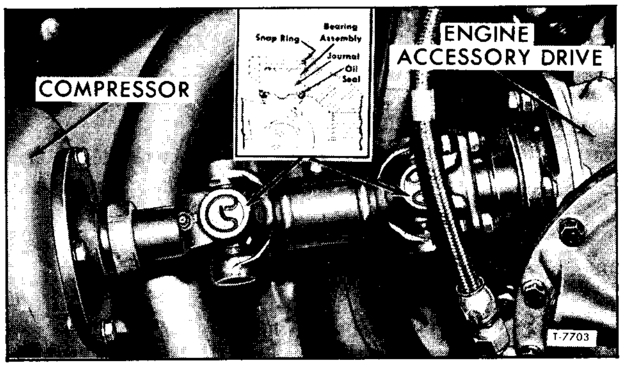


Figure 54—Compressor Drive Propeller Shaft

Apply one pump of gun every 3,000 miles of vehicle operation.

PROPELLER SHAFT REMOVAL

NOTE: Figure 54 shows propeller shaft installed.

Remove four bolts, nuts, and washers which attach propeller shaft flange to engine accessory drive shaft flange. Separate flanges then pull opposite end of shaft from splined compressor clutch shaft.

PROPELLER SHAFT INSTALLATION

NOTE: Refer to figure 54.

NOTE: Slip yoke cork seal and cap on clutch housing can be readily replaced after prying cap from housing. If necessary, install new seal and cap. Crimp cap edges in three places over housing extension.

Coat splines of clutch shaft with special grease, then engage slip-yoke end of shaft assembly over splines of compressor clutch shaft and attach flange at opposite end to engine flange with four bolts, nuts, and lock washers. Tighten nuts firmly.

UNIVERSAL JOINT BEARING REPLACEMENT (Refer to Fig. 54)

Removal

1. Remove snap rings which retain bearings in shaft yokes.

2. Strike one side of yoke with soft hammer to force one bearing assembly out of yoke. Strike opposite side of yoke to force opposite bearing out.

CAUTION: DO NOT DROP BEARINGS.

3. Journal can now be tilted to permit removal of yoke from journal.

4. Remove the retaining two bearing assemblies in same manner to permit removing journal from other yoke.

Installation

1. NOTE: Make sure oil seals are in place securing needle rollers in bearing. Apply recommended grease to needles to provide initial lubrication.

2. Install journal in yoke, then install bearing assemblies in yoke over journal trunnions. Use a soft hammer to tap bearings into place.

3. Install snap rings into yoke groove to secure bearings in yoke.

IMPORTANT: Make sure snap rings are fully seated in yoke grooves.

PROPELLER SHAFT ALIGNMENT

IMPORTANT: The compressor must be aligned properly with engine drive shaft otherwise early failure of the drive shaft bearings and other drive line components will occur.

The air conditioning compressor alignment must be checked whenever any of the following conditions occur:

1. The vehicle is involved in a rear end collision.
2. The engine is removed.
3. The air conditioning unit is removed.
4. The engine stabilizer bars are disturbed.
5. The engine support mounting insulators are replaced.
6. Any other incidents which may disturb the engine mountings and supports, or the air conditioning compressor in any way.

Procedures to properly align compressor to accessory drive unit are listed previously under "Compressor Installation" in this section.

REFRIGERANT COMPRESSOR DRIVE CLUTCH

The compressor drive clutch (fig. 53), enclosed by an aluminum housing, is mounted to drive end of compressor. Clutch is of the conventional automotive type and is actuated by an air-powered cylinder assembly mounted to side of compressor.

When air CYLINDER IS PRESSURIZED (push rod retracted, the CLUTCH BECOMES ENGAGED. Likewise when PRESSURE IS EXHAUSTED from cylinder (push rod extended) CLUTCH BECOMES DISENGAGED. NOTE: Air cylinder push rod is extended by pressure of two coil springs within cylinder assembly.

The clutch input shaft, which is propeller shaft driven from engine accessory drive, is engaged directly to the clutch drive plate assembly. Thus the drive plate is turning whenever the coach engine is running. When clutch is engaged by action of the air cylinder, the Belleville spring of clutch pressure plate is released. This action releases pressure plate to engage both drive plate and compressor flywheel to turn the compressor. Large arrows on figure 53 indicate the power flow from the drive shaft input through the clutch to the compressor. Clutch components can be replaced without having to remove compressor from coach.

Overhaul of the clutch components are explained later under "Clutch Overhaul."

CLUTCH DRIVE PLATE AND COVER ASSEMBLY REPLACEMENT

IMPORTANT: One special tool, which can be improvised locally, is necessary for making these replacements. DO NOT ATTEMPT TO MAKE REPLACEMENTS UNLESS THIS TOOL IS AVAILABLE. Tool is used for holding drive plate in alignment when installing cover assembly to clutch flywheel. Cut off a portion of an old clutch shaft at a point shown in figure 55. This part can also be made up from an old Chevrolet mechanical transmission main drive (clutch) gear.

REMOVAL

1. Using run-up blocks, raise rear of coach to provide access below compressor compartment. Set parking brake.

2. Place engine control switches in engine compartment to "OFF" position.

3. Remove stone shield from below compressor and from under engine at left side.

4. Remove compressor drive shaft assembly.

NOTE: If necessary to rotate shaft for access to flange bolts, turn engine crankshaft using a 1-1/2-inch socket wrench on lower crankshaft pulley nut.

5. Spring-loaded clutch cylinder (27, fig. 53) must be disconnected from clutch release fork (18, fig. 53). In order to remove fork connecting pin (24, fig. 53), disconnect cylinder air line hose at air control solenoid valve, then apply shop air pressure through hose into air cylinder (min. air pressure required - 65 lbs.). This action will relieve pressure on cylinder yoke pin, allowing pin to be removed.

6. Remove bolts which attach clutch housing to compressor adapter. Separate housing evenly from compressor.

7. Move clutch housing rearward into propeller shaft opening in body bulkhead or remove housing from compartment if desired. Remove clutch cover attaching bolts evenly, then remove

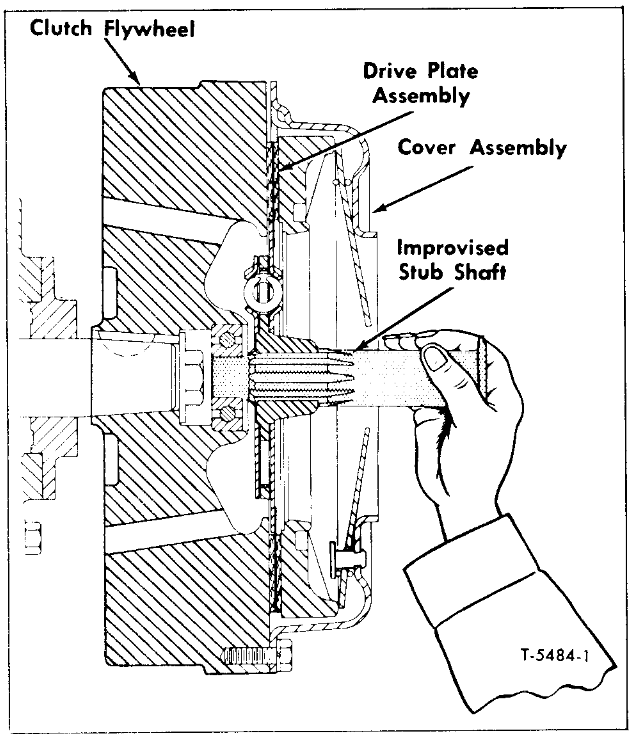


Figure 55—Using Improvised Shaft for Installing Clutch (Typical)

clutch drive plate and cover assembly from flywheel.

NOTE: Compressor flywheel and pilot bearing can be replaced as directed later under "Clutch Overhaul." Also, the clutch shaft can be separated from housing as directed later under "Clutch Housing and Shaft Disassembly."

INSTALLATION OF DRIVE PLATE AND COVER ASSEMBLIES

NOTE: Before installing clutch components, check pilot bearing for roughness, lack of lubricant, and also check friction surface of flywheel. Repair or replace if necessary. The cavity within the flywheel pilot bearing should also be full of "SPECIAL" lubricant listed in LUBRICATION (SEC. 13) of this manual.

1. Locate clutch drive plate assembly and clutch cover assembly to flywheel.

IMPORTANT: Make sure that stamped side (PRESSURE PLATE SIDE) of drive plate is positioned with long side of the hub away from the flywheel as shown in figure 55.

NOTE: Be sure alignment mark "X" on flywheel is aligned with "X" mark on cover and pressure plate assembly.

2. Using improvised stub shaft as shown in figure 55, insert shaft into splines of drive plate and then into pilot bearing within clutch flywheel.

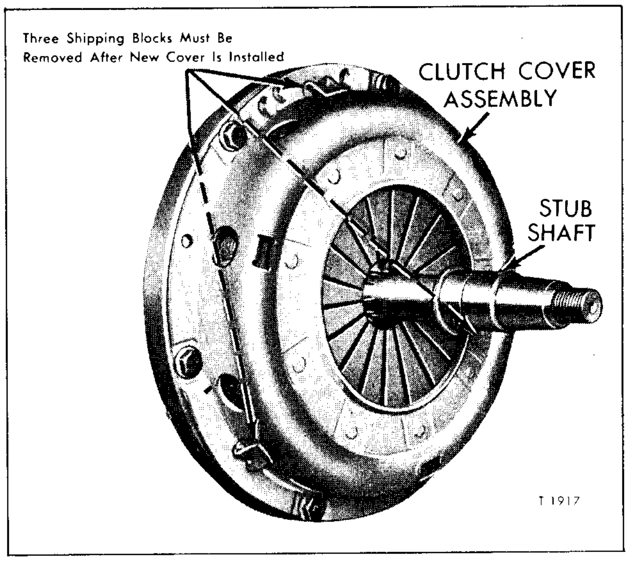

Three Shipping Blocks Must Be Removed After New Cover Is Installed
CLUTCH COVER ASSEMBLY
STUB SHAFT
T 1917

Figure 56—Clutch Shipping Blocks Installed

3. Carefully line up clutch cover with flywheel, then install cover attaching bolts and lock washers alternately. This will prevent distorting clutch cover when compressing clutch spring.

IMPORTANT: If a new cover assembly was installed, pry these shipping blocks from around cover. Blocks are located as shown in figure 56.

NOTE: Cover attaching bolts should be tightened to approximately 40 foot-pounds torque. Remove improvised stub shaft from clutch drive plate.

4. Position clutch housing assembly with shaft over clutch to housing adapter. Rotate clutch shaft to engage drive plate splines and then the pilot bearing. Attach housing evenly to adapter with seven bolts and washers. Tighten bolts firmly.

5. Apply shop air pressure to clutch control air cylinder, then install cylinder to release fork

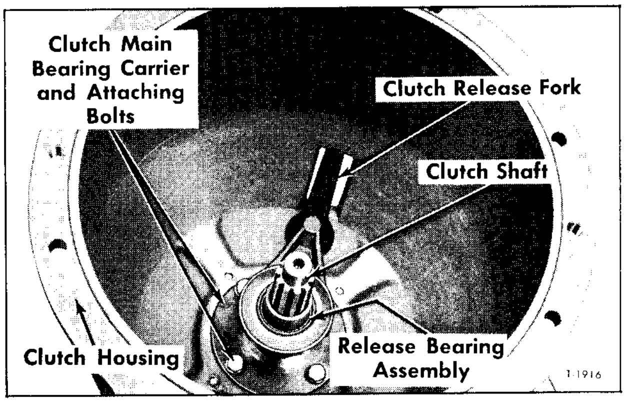


Figure 57—Clutch Fork and Drive Shaft Installed in Clutch Housing

clevis pin, pin (washer) retainer, and rubber O-ring (24, 23, and 22, fig. 53). Attach cylinder air line to air control solenoid valve.

6. It may be necessary to rotate engine flange for alignment of shaft with clutch shaft splines.

7. Fasten stone shields under compressor and engine.

8. Place engine control switches in the engine compartment in operating positions.

9. Remove coach from run-up blocks.

CLUTCH OVERHAUL

CLUTCH HOUSING AND SHAFT DISASSEMBLY

Key numbers in text refer to figure 53.

Figure 57 shows assembly removed.

1. Using open-end wrench, turn ball stud (16) and lock washer (15) from clutch housing. Remove stud with clutch release fork (18). Slide release bearing (14) from retainer (10). Remove retainer spring (17) holding ball stud in fork.

2. Remove four bolts (3), and lock washers (4) which attach main bearing carrier (5) with shaft as a unit from housing.

3. Remove four bolts (12) and lock washers (11) attaching main bearing retainer (10) to main bearing carrier. Remove retainer and carrier from clutch shaft (9). Remove felt (6) from carrier.

4. Using snap ring pliers, remove bearing retainer ring (7) from clutch shaft. Using arbor press, force main bearing assembly (8) from shaft.

ASSEMBLY OF CLUTCH HOUSING AND SHAFT

Key numbers in text refer to figure 53.

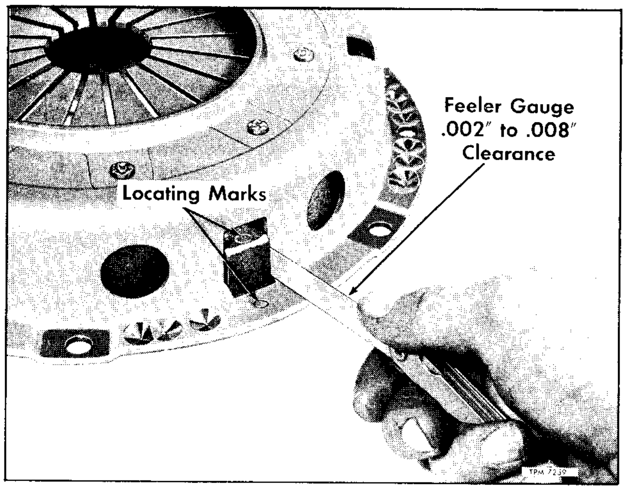


Figure 58—Clutch Cover-to-Plate Alignment Marks and Driving Lug Clearance Check

Figure 57 shows assembly removed.

1. Press main bearing assembly (8) onto clutch shaft (9), making sure unshielded side of bearing is toward flange on shaft.

2. Install bearing retainer ring (7) into ring groove on shaft.

3. Pack cavity of main bearing carrier (5) with same grease recommended for compressor drive shaft. Refer to LUBRICATION (SEC. 13). Install felt (6) in carrier over the grease with taper of seal positioned to mate taper in carrier. Referring to figure 53 for position of parts, place carrier on shaft and bearing, then position main bearing retainer (10) over bearing to carrier. Install retainer to carrier with four bolts and lock washers. Tighten bolts firmly.

4. Install carrier and shaft assembly into clutch housing with four bolts and lock washers. Tighten bolts evenly and firmly.

NOTE: It may be necessary to tap carrier into housing.

5. Pack ball stud socket of clutch release fork (18) with wheel bearing grease, then insert ball stud (16) into socket. Secure stud with retainer spring (17). Make sure both ends of spring are located in fork.

6. Pack inner bore of clutch release bearing (14) with molybdenum base zinc oxide, then slide clutch release bearing (14) over main bearing retainer to position shown in figure 51.

7. Install clutch release fork (18) to clutch housing, using new external lock washer on ball stud. Tighten stud firmly. Figure 57 shows assembly built up.

CLUTCH PRESSURE PLATE AND COVER DISASSEMBLY

Key numbers in text refer to figure 53.

NOTE: Check clearance between driving lugs of pressure plate (29) and mating slots in clutch cover (28) in manner shown in figure 58. If clearance is greater than 0.008", examine cover and lugs of pressure plate for wear and if necessary, replace worn parts.

If locating marks "O" on cover and pressure plate (fig. 58) are not visible, mark parts as shown. Remove pressure plate retracting spring bolts (20), remove springs (19), then separate pressure plate from cover.

NOTE: Pressure plate can be resurfaced and other components checked as directed later under "Inspection and Repair."

ASSEMBLY OF CLUTCH PRESSURE PLATE AND COVER

NOTE: Key numbers in text refer to figure 53.

1. Apply light coat of graphite grease on sides of pressure plate driving lugs; then install

plate in cover, making sure balance mark "O" on cover (28) is matched with corresponding mark on pressure plate (29). Refer to figure 58.

2. Install three retracting springs (19) on pressure plate (29). There must not be any clearance between clutch spring and retracting spring when spring attaching screws are tight.

CLUTCH FLYWHEEL AND PILOT BEARING REPLACEMENT

Key numbers in text refer to figure 53.

Removal

1. Remove pilot bearing (31) from compressor flywheel, using a conventional bearing puller tool.

2. Using proper size wrench socket, remove bolt (32), and flat washer (33) which attach flywheel (34) to compressor shaft (fig. 59). Using a suitable puller, remove flywheel and flywheel key (35). Flywheel can be resurfaced as directed later. Pilot bearing should be checked as directed under "Inspection and Repair."

NOTE: Flywheel can be retained when loosening or tightening flywheel bolt using a large cotter pin, chained to compressor platform (fig. 59). Insert pin from back side.

Installation (Fig. 53)

NOTE: Apply a light film of S.A.E. 10 oil to taper of compressor shaft.

1. Insert drive key (35) into slot of compressor or crankshaft, then with flywheel aligned, position flywheel to compressor. Install flywheel flat washer (33) and special bolt (32). Tighten bolt to 60 to 65 foot-pounds torque in manner shown in figure 59.

2. Pack cavity around head of flywheel attaching bolt with special grease recommended for propeller shaft in LUBRICATION (SEC. 13); then press pilot bearing (31) evenly into flywheel.

IMPORTANT: Shielded side of bearing must face cavity.

INSPECTION AND REPAIR OF CLUTCH COMPONENTS

Key numbers in text refer to figure 53.

1. Wash all parts in cleaning solvent, except bearings and clutch drive plate assembly (30).

2. Carefully examine clutch cover and spring assembly (28). Check spring for wear at inner end of levers at point contacted by release bearing (14). Also look for wear and fractures at outer rim of clutch spring. Replace complete cover and spring assembly if any of the component parts are damaged or worn.

3. Inspect pressure plate (29) for scoring on contact surface. Regrind pressure plate if plate is grooved, rough, heat checked, or cracked. Replace with new plate if distorted or if driving lugs are worn.

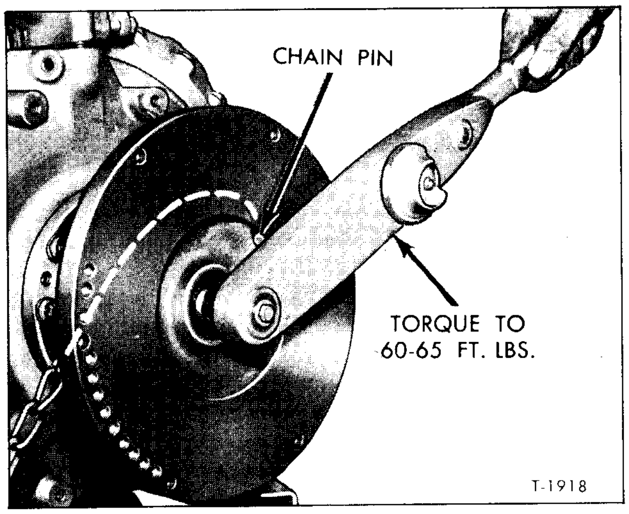


Figure 59—Tightening Flywheel Bolt (Typical)

4. Inspect contact surface of compressor flywheel (34) for grooved or worn condition. Flywheel can also be ground down as explained later.

5. Replace pilot bearing (31), clutch release bearing (14), and clutch shaft main bearing (8) if bearings are rough or damaged.

RESURFACING PRESSURE PLATE

Before resurfacing pressure plate, a check should be made to determine whether plate has been resurfaced previously. This may be determined by measuring from the front surface of plate to the surface at rear side which is contacted by the Belleville spring. Dimensions of new pressure plate is 1.0945" to 1.0970". Not more than 0.045-inch of stock may be removed from contact surface by grinding. If pressure plate is to be resurfaced, proceed as follows:

1. Grind off friction surface of pressure plate as necessary to produce a flat surface. If necessary to reduce plate thickness more than 0.045-inch to restore smooth flat surface, plate should be discarded and replaced with a new part.

2. After plate has been resurfaced, measure thickness as directed above. Subtract thickness of resurfaced plate from thickness of new plate to determine how much stock has been removed during resurfacing operation.

RESURFACING COMPRESSOR FLYWHEEL

Grind from wear surface of flywheel rim, the same amount of stock as was removed from pressure plate. This is necessary to maintain torque capacity of clutch. When refacing is done properly, the clutch spring will be flat when clutch parts are assembled to flywheel, that is, the inner end of fingers will be in same plane as the outer rim of spring, or fingers may slant slightly rearward.

CLUTCH CONTROL AIR CYLINDER

Clutch control air cylinder (fig. 61), pivot-mounted to side of compressor, is employed to engage and disengage the compressor clutch. When cylinder push rod is retracted by air pressure supplied by the control air solenoid valve, clutch becomes engaged. When solenoid valve closes, exhausting air supply to cylinder, springs within cylinder extend the push rod to cause clutch to become disengaged.

Air, which is drawn into vented end of air cylinder when clutch is disengaged, enters through an air strainer assembly, mounted to pivot end of cylinder. Air strainer should be removed and cleaned after every three months of operation, or more often if subject to operation under extreme dusty conditions.

At 10,000 mile intervals, one ounce of clean S.A.E. 10 engine oil should be admitted into cylinder after removing small hex plug.

AIR CYLINDER REMOVAL

1. Disconnect coach air supply line at air cylinder and apply shop air pressure to cylinder to free clevis pin at clutch release fork.
2. Remove rubber O-ring and flat rubber washer at lower end of cylinder push rod yoke pin. Remove pin from yoke and clutch release fork, then disconnect shop air pressure from cylinder.
3. Remove O-ring retainer and remove pin and four thrust washers from pivot-end of cylinder attached to compressor brackets (fig. 60). Carefully lower cylinder from compartment.

NOTE: DO NOT lose O-ring retainer or thrust washers from compressor bracket end of cylinder (fig. 60).

4. If necessary, remove air strainer assembly from rear cover of cylinder. Instructions for cleaning air strainer are explained later.

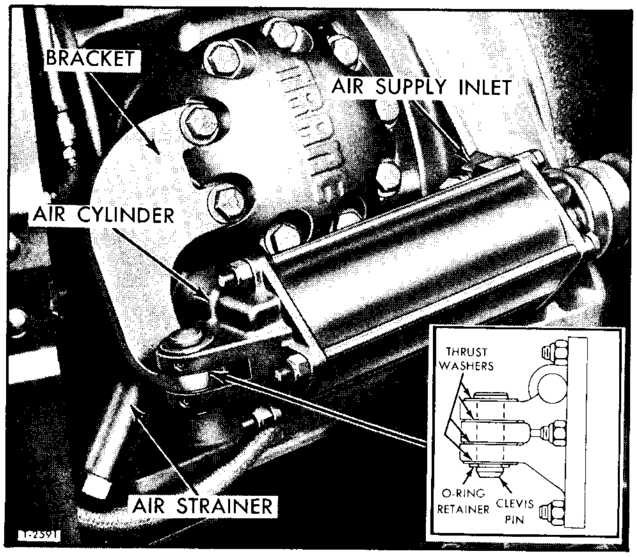


Figure 60—Clutch Control Air Cylinder Installed (Typical)

AIR CYLINDER INSTALLATION

1. Check to see that attaching bolts of cylinder pivot mounting bracket are tight.
2. Apply small quantity of Lubriplate to pivot end of cylinder and to yoke at push rod end of cylinder.
3. Raise the cylinder assembly into position. Locate washers as shown in figure 60. Attach pivot end of cylinder to mounting bracket with clevis pin and O-ring retainer.
4. Connect shop air supply line to air cylinder to retract cylinder push rod.
5. Check and adjust clutch controls as explained previously under "Clutch Release Adjustment."
6. After proper adjustment is obtained, make certain that flat rubber washer and rubber O-ring (23 and 22, fig. 53) are installed to lower end of push rod yoke pin. See insert on figure 52.
7. Connect air line.

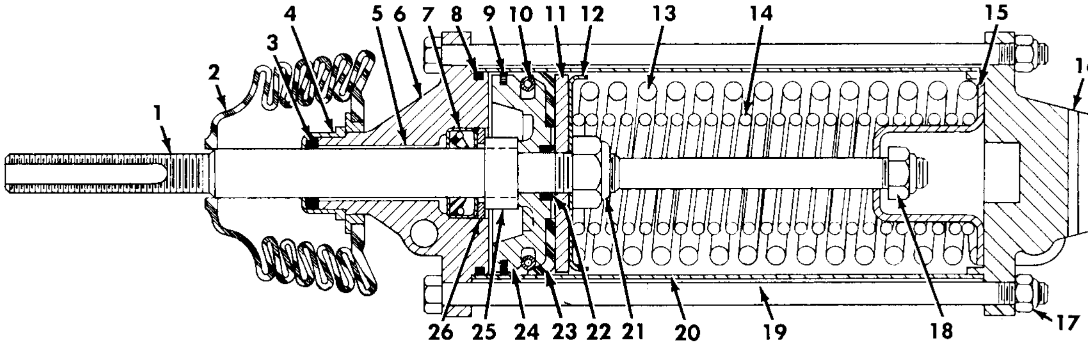
CYLINDER OVERHAUL

DISASSEMBLY

Key numbers in text refer to figure 61.

1. Mark cylinder front cover (6), cylinder tube (20), and rear cover (16) to assure proper alignment when assembled later.
2. Remove boot (2) from push rod and front cover.
3. Remove nut (17) from ends of four bolts (19) retaining cylinder assembly together. Remove bolts.
4. Separate front cover (6) with push rod and springs from cylinder tube and rear cover. Slide front cover (6) from push rod, being careful not to damage push rod seal (7).
5. Remove O-ring (8) from groove of front cover.

NOTE: At this point of disassembly the condition of piston components can be checked.



1 Push Rod
2 Push Rod Boot
3 Seal
4 Seal Cap
5 Push Rod Bushing
6 Front Cover Assembly
7 Push Rod Seal Assembly
8 Tube O-Ring
9 Piston Felt
10 Expander Spring
11 Piston Plate
12 Spring Retainer
13 Spring (Large Diameter)
14 Spring (Small Diameter)
15 Spring Retainer Cup
16 Rear Cover
17 Nut
18 Push Rod Nut
19 Bolt
20 Cylinder Tube
21 Push Rod Nut
22 O-Ring
23 Piston Cup
24 Piston Follower
25 Spacer
26 Seal Washer

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Figure 61—Clutch Control Air Cylinder Assembly

To disassemble piston components, an arbor press having sufficient travel is necessary for compressing springs to allow removal of inner push rod nut (18).

CAUTION

DO NOT ATTEMPT TO DISASSEMBLE OR ASSEMBLE SPRINGS WITHOUT PROPER EQUIPMENT, AS SERIOUS INJURY COULD RESULT.

6. Using arbor press with a suitable fixture that will prevent the springs from "snaking" out of position, remove push rod nut (18). Carefully back off arbor press to remove tension on springs. Remove spring retainer cup (15) and springs.

7. Remove push rod nut (21), then remove spring retainer (12), piston plate (11), piston cup (23), expander spring (10), and piston felt (9).

8. O-ring (22) can be removed from piston follower (24).

9. Slide spacer (25) from push rod.

10. If necessary, seal washer (26) and seal assembly (7) can be removed from front cover (6).

CLEANING AND INSPECTION

Clean all parts thoroughly, then inspect cylinder tube (20) and piston cup (23).

ASSEMBLY

Key numbers in text refer to figure 61. Refer to this view for positioning of parts when assembling unit.

1. Install new seal assembly (7) into front cover (6).

IMPORTANT: Lip of seal must face piston components.

Install seal washer (26). Stake washer in four places.

2. Slide small diameter end of push rod (1) into boot end of front cover (6) and through seal.

3. Place spacer (25) into position on push rod.

4. Place piston follower (24) on push rod, then install small O-ring (22) into recess of follower.

5. Referring to figure 61 for proper positioning of parts, install piston felt (9) and expander spring (10) into grooves of follower (24), install piston cup (23), piston plate (11), spring retainer (12) and new push rod nut (25). Tighten nut firmly.

6. Place push rod and front cover in arbor press fixture, then place springs (13 and 14) into position. Carefully press spring retainer cup (15)

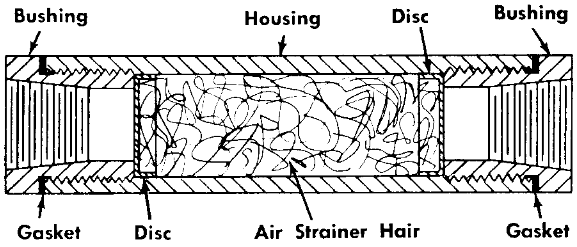


Figure 62—Air Strainer Assembly

over end of push rod to allow installation of new push rod nut (18). Tighten nut firmly.

7. Locate tube O-ring (8) into groove of front cover.

8. Coat inside of cylinder tube (20) with Lubriplate, then place tube over springs to front cover. Locate rear cover (16) to tube. Align marks on tube and covers which were made prior to disassembly. Install four bolts (19) and nuts (17). Tighten nuts evenly.

9. If previously removed, install seal (3) and seal cap (4).

10. Apply small quantity of clean grease to push rod, then install push rod boot (2) to front cover.

CYLINDER AIR STRAINER

Air strainer (fig. 62), installed at pivot end of air cylinder, should be removed and cleaned after every three months of operation, or more often if subject to extreme dusty conditions.

Soak strainer material in cleaning solution, then flush strainer. Allow material to dry, then assemble strainer. Replace gaskets if necessary. Tighten end bushings firmly. Install strainer.

COMPRESSOR ACCESSORY DRIVE

The accessory drive, as used to transfer power of coach engine to operate the air conditioning refrigerant compressor, consists of a bevel drive gear and pinion enclosed within engine fan drive housing, as shown in figure 63.

Referring to figure 63, engine torque is transferred from fan drive pinion (17) to the bevel gear (16) at a ratio of 1.0 to 1.58.

Bevel gear (16, fig. 63) is supported in bearing retainer (8, fig. 63) on two tapered roller bearings which are lubricated by engine oil pressure through internal drilled passages. Bearing retainers (8 and 35, fig. 63) of both gears can be 0.001" press fit to 0.001" loose fit in opening of accessory drive housing.

BEVEL GEAR AND PINION ARE USED IN MATCHED SETS ONLY.

Adjustment of gear blacklash and tooth contact is accomplished by removing or adding shims (9 and 37, fig. 63) which relocate position of one gear in relation to the other. Instructions for making adjustments are explained later under "Bevel Gear and Pinion Adjustments."

BEVEL GEAR AND BEARING RETAINER REMOVAL

Key numbers in text refer to figure 63.

1. Remove nut (1), which attaches propeller shaft flange (3) to drive gear (16). Remove flange and flange key (38).

2. Mark position of bearing retainer (8) in relation to accessory drive housing to assure original position when installing later.

3. Remove bearing retainer bolts and lock washers.

4. Install two puller screws into tapped holes in bearing retainer and force bearing retainer evenly from housing. Remove puller screws. Retain shim pack (9) to assure original gear backlash if it was found satisfactory.

5. Disassemble bevel gear and retainer unit as explained later under "Bevel Gear and Bearing Retainer Disassembly."

BEVEL GEAR AND BEARING RETAINER DISASSEMBLY

Key numbers in text refer to figure 63.

1. Remove O-ring seal (10) from groove in bearing retainer.

2. Using sharp bladed tool, pry oil seal assembly (4) from bearing retainer.

3. Bend down tab of adjustment nut lock (7).

4. Position bevel gear assembly in a vise having soft jaws, then remove adjustment nut (6). Remove nut lock.

5. Support bevel gear retainer (4) in an arbor press and force bevel gear with inner bearing cone (14) and bearing adjustment spacer (13) from retainer. Remove spacer from shaft. If inner bearing needs replacement, remove bearing using arbor press and remover plates.

6. Remove outer bearing cone assembly (11) from retainer.

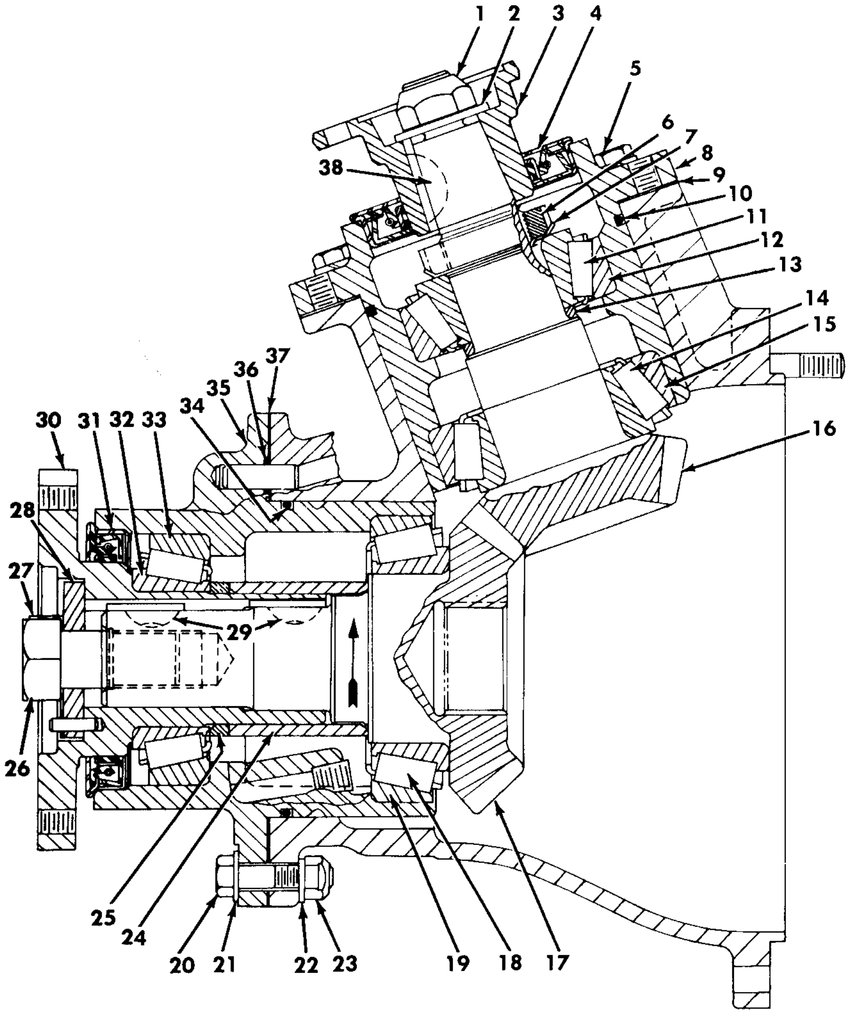
7. If necessary, bearing cups (12 and 15) can be removed from retainer, using suitable puller equipment.

CLEANING AND INSPECTION

1. Clean all parts in cleaning solvent. Wipe or blow parts dry.

2. Inspect rollers of bearing cones for nicks and worn spots. Inspect bearing cups also for indication of wear. Replace cones and cups if not in good condition. After cleaning and inspection of bearing parts, lubricate parts generously with clean engine oil, then wrap in clean lint-free cloth or paper until ready to install.

3. Check teeth of bevel gear for poor tooth contact pattern, nicks, or worn condition.



1	Lock Nut
2	Washer
3	Flange
4	Oil Seal
5	Bolt
6	Lock Nut
7	Lock Washer
8	Bevel Gear Bearing Retainer
9	Shims (As Req'd.)
10	O-ring
11	Bevel Gear Outer Bearing
12	Outer Bearing Cup
13	Bearing Spacer (Selective)
14	Bevel Gear Inner Bearing
15	Inner Bearing Cup
16	Bevel Gear
17	Pinion Gear
18	Pinion Gear Inner Bearing
19	Inner Bearing Cup
20	Bolt
21	Flat Washer
22	Lock Washer
23	Lock Nut
24	Bearing Spacer
25	Bearing Spacer (Selective)
26	Bolt
27	Lock Plate
28	Washer Assembly
29	Keys
30	Fan Drive Hub
31	Oil Seal
32	Pinion Gear Outer Bearing
33	Outer Bearing Cup
34	O-ring
35	Pinion Gear Bearing Retainer
36	O-ring
37	Shims (As Req'd.)
38	Key

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Figure 63—Compressor Accessory Drive (Typical)

NOTE: Bevel gear and pinion are serviced in matched set only.

ASSEMBLY OF BEVEL GEAR AND BEARING RETAINER

Key numbers in text refer to figure 63. Coat all parts in clean S.A.E. 30 engine oil when assembling unit.

1. If bevel gear inner bearing cone (14) was removed from bevel gear at disassembly, install inner bearing cone using a suitable sleeve and arbor press. Support bevel gear on soft metal or hardwood block and seat bearing race firmly at shoulder (fig. 64).

2. Install bearing adjustment spacer (13) on shaft of bevel gear.

3. Inspect counterbores in bearing retainer (18) which must be clean.

4. Use a suitable driver and arbor press and install bearing cups (12 and 15) in retainer.

5. Apply engine lubricant on bearing assemblies; then set the retainer in place on bevel gear, making sure key (38) is in shaft.

6. Install outer bearing cone (11), adjustment nut lock (7), and adjustment nut (6).

NOTE: Care should be taken to prevent nut lock from turning with adjustment nut.

7. Support teeth of bevel gear in a soft jaw vise; then adjust gear bearing preload as follows:

a. Tighten bearing adjustment nut (6) to 175 to 200 foot-pounds torque.

b. Wrap a heavy cord around bearing retainer and attach a spring scale as shown in figure 65. Rotate bearing retainer by pulling on spring scale.

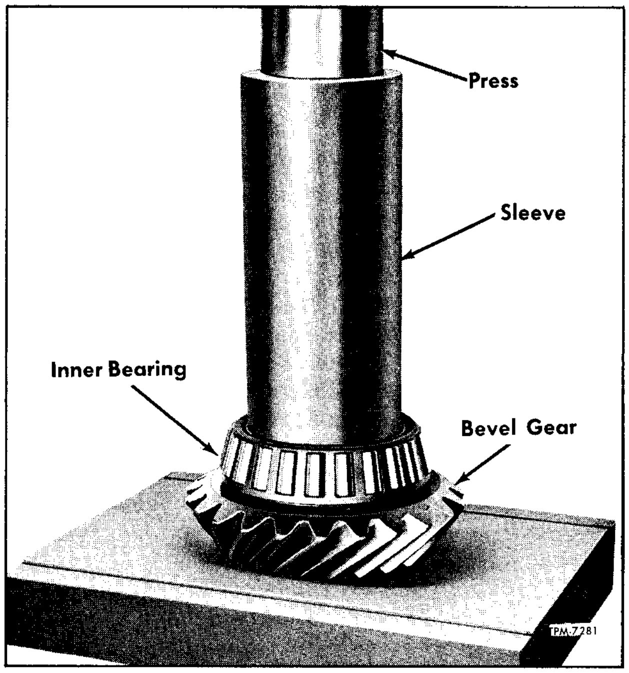

Figure 64—Installing Bevel on Pinion Gear Inner Bearing

Correct bearing preload will require a 5 to 15 pound pull to rotate retainer. If necessary, replace bearing adjustment spacer (13) with another size. Select smaller size to increase preload; larger size to decrease preload.

Spacers of various sizes are available in thicknesses shown in chart following:

c. When correct adjustment is obtained, lock adjustment nut by bending up tab of lock (7).

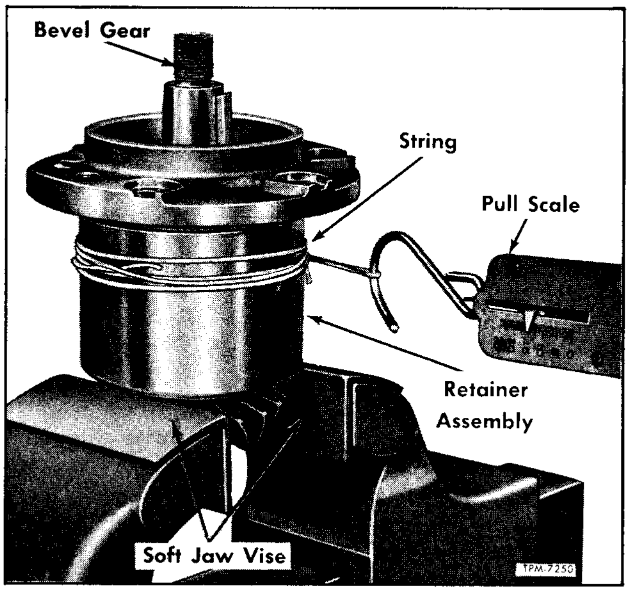

Figure 65—Checking Bevel Gear Adjustment

BEVEL GEAR BEARING SPACER CHART

GM Part No.	Thickness	Stamped
2389880	.224" -.223"	P-24
2397019	.2225"-.2215"	P-225
2389879	.221" -.220"	P-21
2397018	.2195"-.2185"	P-195
2389878	.218" -.217"	P-18
2397017	.2165"-.2155"	P-165
2389877	.215" -.214"	P-15
2397016	.2135"-.2125"	P-135
2389876	.212" -.211"	P-12
2397015	.2105"-.2095"	P-105
2389875	.209" -.208"	P-09
2397014	.2075"-.2065"	P-075
2389874	.206" -.205"	P-06
2397013	.2045"-.2035"	P-045
2389873	.203" -.202"	P-03
2397012	.2015"-.2005"	P-015
2386043	.200" -.199"	P-00
2397011	.1985"-.1975"	P-985
2389872	.197" -.196"	P-97

PINION GEAR AND BEARING RETAINER REMOVAL

Key numbers in text refer to figure 63.

1. Remove bearing retainer attaching bolts (20) and lock washers (21).

2. Install two puller screws into tapped holes in bearing retainer (35). See figure 66. Force bearing retainer evenly from housing by alternately turning puller screws 1/2 turn each. Remove puller screws. Retain shim pack (37) to assure original gear backlash if it was found satisfactory.

3. Disassembled pinion gear (17) and retainer unit as explained later under "Pinion Gear and Bearing Retainer Disassembly."

PINION GEAR AND BEARING RETAINER DISASSEMBLY

Key numbers in text refer to figure 63.

1. Bend lock plate (27) against washer (28).

2. Position pinion gear assembly in a vise having soft jaws, then remove shaft bolt (26), lock plate (27), and washer (28).

3. Support retainer (35) in an arbor press and force pinion gear (17) with inner bearing (18) and spacer (24) from retainer. Remove spacer from shaft. If inner bearing needs replacement, remove bearing using arbor press.

4. Support bearing retainer (35) in an arbor

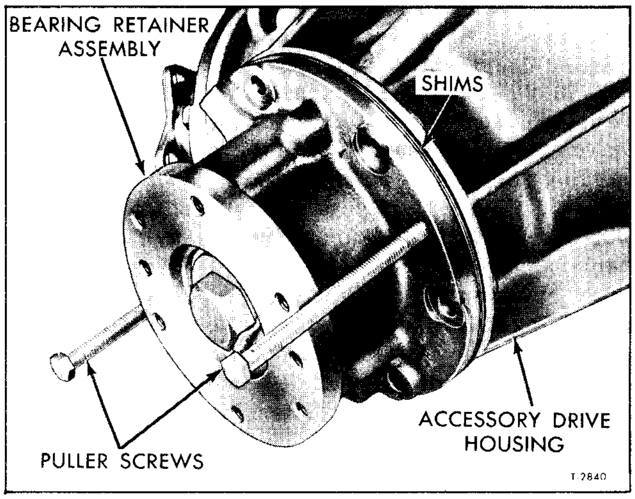

Figure 66—Using Puller Screws to Remove Retainer

press and force fan drive hub (30) with bearing spacer (25), outer bearing (32), and seal (31) from retainer.

5. Remove bearing spacer (25), bearing (32), and seal (31) from fan drive hub. Use suitable puller to remove outer bearing.

6. If necessary, bearing cups (19) and (33) can be removed from retainer (35) using suitable puller equipment.

CLEANING AND INSPECTION

Instructions for cleaning and inspecting pinion gear and bearing retainer parts will be the same as specified following "Bevel Gear and Bearing Retainer Disassembly."

ASSEMBLY OF PINION GEAR AND BEARING RETAINER

Key numbers in text refer to figure 63. Coat all parts in clean S.A.E. 30 engine oil.

1. If pinion gear inner bearing cone (18) was removed from gear at disassembly, install bearing cone using a suitable sleeve and arbor press. Support gear on soft metal or hardwood block and seat race firmly at shoulder (fig. 64).

2. Install spacer (24) on shaft of pinion gear.

3. Inspect counterbores in bearing retainer (35) which must be clean.

4. If removed at disassembly, use a suitable driver and arbor press and install bearing cups (19 and 33) in retainer.

5. Apply engine oil on bearing assemblies, then set the retainer in place on bevel gear.

6. Install outer bearing (32) on fan drive hub (30) in arbor press. Apply small amount of grease to inside diameter of bearing spacer (25) and install on fan drive hub.

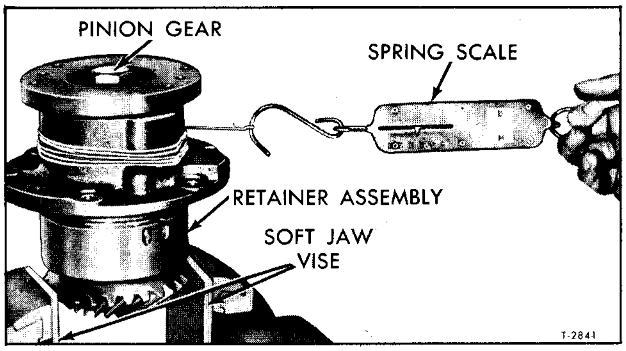

Figure 67—Checking Pinion Gear Adjustment

7. Making sure keys (29) are installed in shaft, press fan drive hub into bearing retainer. Install washer (28), lock plate (27), and bolt (26).

8. Support teeth of bevel gear in a soft jaw vise; then adjust gear bearing preload as follows:

a. Torque bolt (26) to 200-225 foot-pounds.

b. Wrap a heavy cord around bearing retainer and attach a spring scale as shown in figure 67. Rotate bearing retainer by pulling on spring scale. Correct bearing preload will require a 10 to 20 pound pull to rotate retainer.

PINION GEAR BEARING SPACER CHART

GM Part No.	Thickness	Stamped
2389893	.289 -.288	R-89
2397031	.2875-.2865	R-875
2389892	.286 -.285	R-86
2397030	.2845-.2835	R-845
2389891	.283 -.282	R-83
2397029	.2815-.2805	R-815
2389890	.280 -.279	R-80
2397028	.2785-.2775	R-785
2389889	.277 -.276	R-77
2397027	.2755-.2745	R-755
2389888	.274 -.273	R-74
2397026	.2725-.2715	R-725
2389887	.271 -.270	R-71
2397025	.2695-.2685	R-695
2389886	.268 -.267	R-68
2397024	.2665-.2655	R-665
2389885	.265 -.264	R-65
2397023	.2635-.2635	R-635
2389884	.262 -.261	R-62
2397022	.2605-.2595	R-605
2389883	.259 -.258	R-59
2397021	.2575-.2565	R-575
2389882	.256 -.255	R-56
2397020	.2545-.2535	R-545
2389881	.253 -.252	R-53

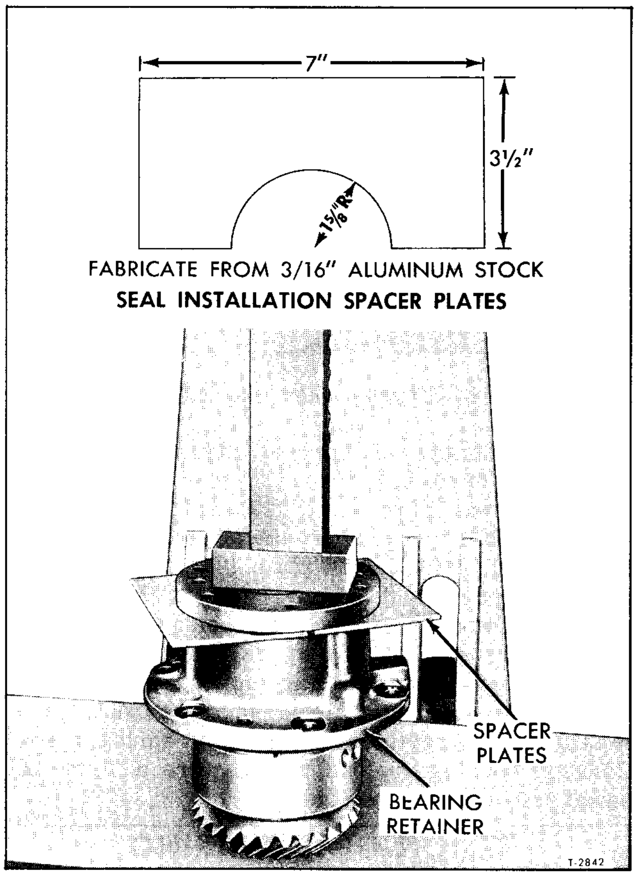
7"
3½"
1⅝"R
FABRICATE FROM 3/16" ALUMINUM STOCK
SEAL INSTALLATION SPACER PLATES
SPACER PLATES
BEARING RETAINER
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Figure 68—Using Spacer Plates to Install Seal

c. If necessary, replace bearing adjustment spacer (25) with another size. Select smaller spacer to increase preload, larger size to decrease preload. Spacers of various sizes are available in thicknesses shown in "Pinion Bearing Spacer Chart" later in this section.

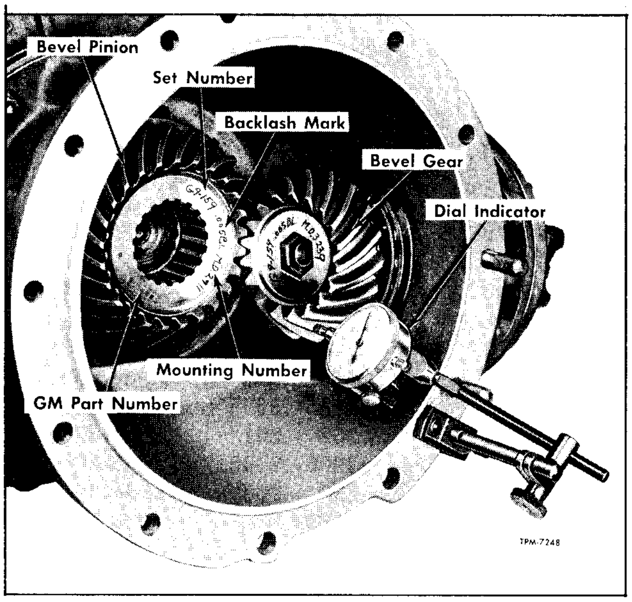


Figure 69—Checking Bevel Gear Backlash

9. When correct preload is obtained, remove fan drive hub assembly and insert seal (31) in bearing retainer (35). Coat outside of seal with sealing compound before installing.

10. Using spacer plates as shown in figure 68, press fan drive hub assembly into bearing retainer. Remove spacer plates by knocking out with hammer. Plates can be improvised locally according to dimensions called out in figure 68.

11. Apply sealing compound to surface of washer, lock plate, and bolt before assembly. Install washer (28), lock plate (27), and shaft bolt and tighten bolt to 200-225 foot-pounds torque. Bend one side of lock plate against shaft bolt.

BEVEL GEAR AND BEARING RETAINER INSTALLATION

Key numbers in text refer to figure 63. The gear and retainer unit can be cooled and the accessory drive housing can be heated.

CAUTION

IF IT IS FOUND NECESSARY TO HEAT THE ACCESSORY DRIVE HOUSING, APPLY HEAT UNIFORMLY TO HOUSING, OTHERWISE THE CASTING MIGHT FRACTURE. HEAT LAMPS HAVE BEEN FOUND SATISFACTORY FOR THIS PURPOSE.

1. Apply clean (S.A.E. #30) engine oil to outer surface of bearing retainer (8) and over O-ring (10) installed in groove of retainer.

2. Locate same pack of adjustment shims (9) removed originally over retainer, then with dowel pin aligned, insert bearing retainer into accessory drive housing.

3. Use two long bolts, opposing each other, to pull retainer into housing, then install bolts (5) and lock washers attaching bearing retainer to accessory drive housing. Tighten bolts evenly and firmly.

4. Install propeller shaft flange with drive key to bevel gear. Coat flats of flange washer and face of flange nut with oil sealant, then install washer and nut. Tighten nut to 100 to 110 foot-pounds torque.

BEVEL GEAR AND PINION ADJUSTMENTS

Key numbers in text refer to figure 63.

Shims (9 and 37) are available in three thicknesses (0.003", 0.010", and 0.031") for adjustment

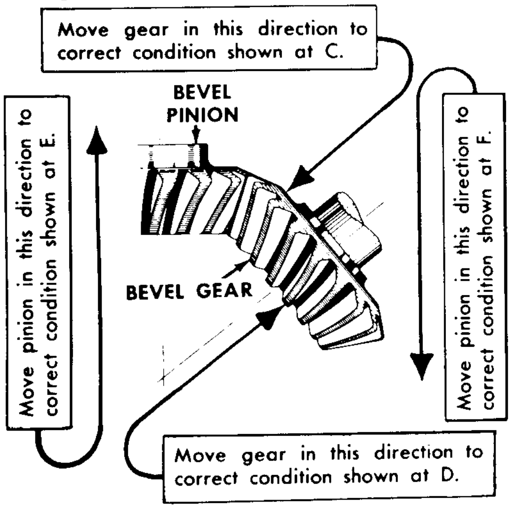
INSTRUCTIONS

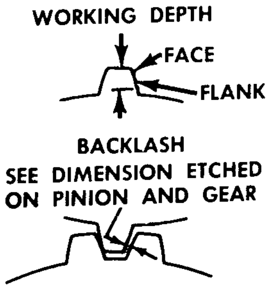
1—Install bevel pinion and bevel gear assemblies; then adjust pinion and bevel gear for proper backlash as directed in "Bevel Gear and Pinion Adjustments" paragraph of this section.

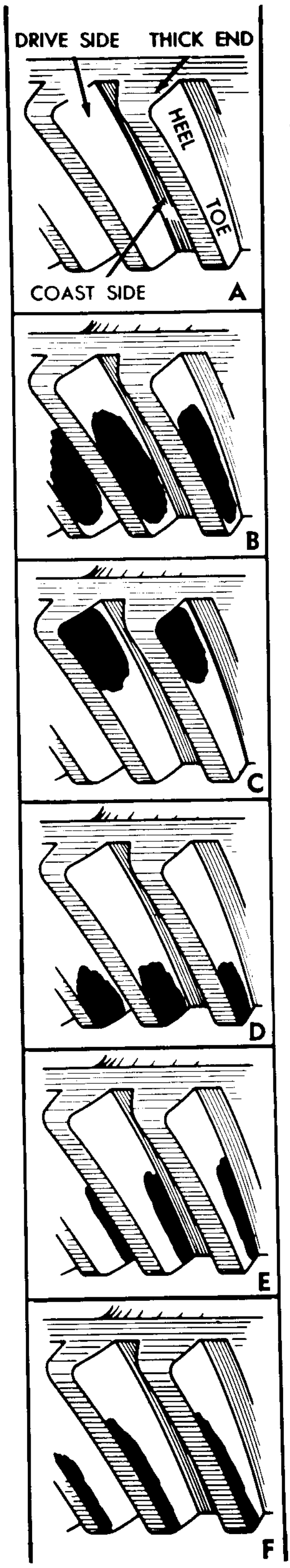
2—Paint three or four teeth of bevel gear with red lead or mechanics blue and rotate bevel gear in direction of rotation until pinion makes complete revolution.

3—Note area of tooth contact which should start at toe and extend about 80 percent of tooth length toward heel, as at B.

4—Vary position of pinion and gear as per chart until proper tooth contact is obtained. Be sure that sufficient backlash has been allowed so that gear can be completely revolved without any highspots being felt.


Move gear in this direction to correct condition shown at C.
Move pinion in this direction to correct condition shown at E.
BEVEL PINION
BEVEL GEAR
Move pinion in this direction to correct condition shown at F.
Move gear in this direction to correct condition shown at D.





A—Check adjustments at drive side of BEVEL GEAR tooth

B—Shows correct tooth contact

NOTE: Key Numbers Below Refer to Figure 63

C—Shows short contact at heel. To correct, decrease shim thickness (9) to move gear toward pinion. Then increase shim thickness (37) to move pinion away from gear to again secure correct backlash.

D—Shows short contact at toe. To correct, increase shim thickness (9) to move gear away from pinion. Then decrease shim thickness (37) to secure correct backlash.

E—Shows heavy contact on flank or lower portion of tooth. To correct, increase shim thickness (37) to move pinion away from gear until contact comes to full working depth of gear tooth without breaking contact at flank. Then decrease shim thickness (9) to move gear toward pinion to secure correct backlash.

F—Shows heavy contact on face or upper portion of tooth. To correct, decrease shim thickness (37) to move pinion toward gear until contact covers flank of tooth without breaking contact at face. Then increase shim thickness (9) to move gear away from pinion to secure correct backlash.

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Figure 70—Accessory Drive Bevel Gear and Pinion Gear Tooth Contact Chart

of backlash and tooth contact of bevel pinion and bevel gear. Figure 63 shows shims installed between accessory drive housing and pinion gear retainer. Whenever assembling accessory drive unit or installing new pinion and bevel gear, or in the event it should become necessary to readjust gear backlash because of mormal wear, the following operations must be accomplished to properly adjust pinion and bevel gear backlash.

Backlash dimension is etched on pinion and bevel gear as shown in figure 69.

1. If accessory drive is installed to coach engine, it must be removed as previously directed.
2. Check gear backlash using dial indicator positioned as shown in figure 69. Dimension should be same as etched on gears. Adjustment can be accomplished through shims (9 and 37) provided between bevel gear bearing retainer (8) and accessory drive housing, and between bevel pinion bearing retainer (35) and accessory drive housing. Shims are of 0.003", 0.010" and 0.031" thickness.
3. To check for proper tooth contact, paint several teeth on pinion gear with a mixture of ground red lead and engine oil or a similar marking compound to provide a method of determining tooth contact.
4. Turn bevel pinion in direction of rotation (fig. 63) and observe tooth contact impression on drive side of gear teeth. Contact should start at toe of tooth (View B, fig. 70) and extend back about 80% of tooth length toward heel. Contact should be distributed evenly over flank and face of tooth, indicating center of contact on pitch line. Refer to Views "A" and "B", figure 70.
   a. If tooth contact is too far out on tooth toward heel (View C, fig. 70), decrease thickness of shim pack (9) between bevel gear bearing retainer (8) and accessory drive housing, moving bevel gear toward pinion. Restore backlash by increasing shim thickness (37) between pinion bearing retainer (35) and accessory drive housing. Figure 63 shows shims (37) installed between pinion gear bearing retainer and accessory drive housing.
   b. If tooth contact extends from toe appreciably less than 80% of tooth contact (View D, fig. 70), move bevel gear away from pinion by increasing shim thickness (9) between bevel gear bearing retainer and accessory drive housing. Restore backlash by decreasing shim thickness (37) between pinion bearing retainer and accessory drive housing.
   c. If tooth contact is low on flank of tooth (View E, fig. 70), move pinion away from bevel gear by increasing shim thickness (37) between pinion bearing retainer and accessory drive housing. Restore backlash by decreasing shim thickness between bevel gear bearing retainer and accessory drive housing.
   d. If contact is high on face of tooth (View F, fig. 70), move pinion toward bevel gear by decreasing shim thickness (37) between pinion bearing retainer and accessory drive housing. Restore backlash by increasing shim thickness (9) between bevel gear bearing retainer and accessory drive housing.
5. When pinion and bevel gear adjustments have been completed, make certain that all retainer attaching bolts and nuts are securely tightened. Recheck adjustment. Remove all red lead from gears.
6. Install accessory drive unit in coach.

System Services and Tests

Contents of this section are listed in Index below:

Subject — Page No.

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Checking Refrigerant Level 177
Using Refrigerant Pressure Gauge Set 178
Charging The System 179
Removing Excess Refrigerant 179
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Checking For Air In System 184
Purging Air From System 184
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Checking Compressor Oil Pump Pressure 187
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NOTE: General instructions for servicing air conditioning system are located on back side of compressor compartment door. Detailed service instructions are explained in this section under respective headings.

CLEANING COILS OF CONDENSER

At regular coach service intervals, check condenser coil external surfaces for dirt or other foreign matter. A clogged coil will cause high discharge pressure and insufficient cooling. Remove filter screen and flush from inner side of coil using water, or water mixed with air.

IMPORTANT: Direct pressure straight through coil to prevent bending fins and do not use extremely high pressure. Do not use hot water or steam.

CHECKING REFRIGERANT LEVEL

Since the refrigerant in the system exists in two forms, liquid and vapor, the heat load in the refrigerant will determine the percentage of liquid to vapor. Since the liquid level is used as the indicator of quantity of refrigerant in the system, it follows that heat load must be a considered factor when checking refrigerant level.

Maximum heat load may be imposed by one or more of the following conditions:

1. Opening door and windows.
2. Parking coach in direct sunlight.
3. Placing coach in line with air flow from wall or overhead heater.
4. Using canvas duct to direct heat and/or steam to coach interior.
5. Use coach heating system to increase temperature (engine running at 1000 rpm).

After the system has been subjected to the heat load for 30 minutes, check refrigerant level at the receiver sight glass (fig. 10). When refrigerant is being added or upon charging after system has been evacuated, the charging should be halted by closing the charging tank supply valve when the liquid appears at the bottom of the sight glass. From the time the refrigerant enters the system until it reaches the receiver, there is a time delay of approximately 2 minutes.

AT NO TIME SHOULD THE LEVEL BE ABOVE THE SIGHT GLASS.

A full charge of refrigerant will weigh from 22 to 24 pounds. In many cases where a nominally empty system is being refilled, less than 24 pounds will be required to obtain the proper level on the sight glass.

NOTE: Overfilling the system can result in high discharge pressure causing excessively high operating temperature.

With a system charged to the bottom of the receiver sight glass, the addition of two pounds of refrigerant will raise the level to the middle of the sight glass. From the bottom of the sight glass a charge of five pounds will overfill the

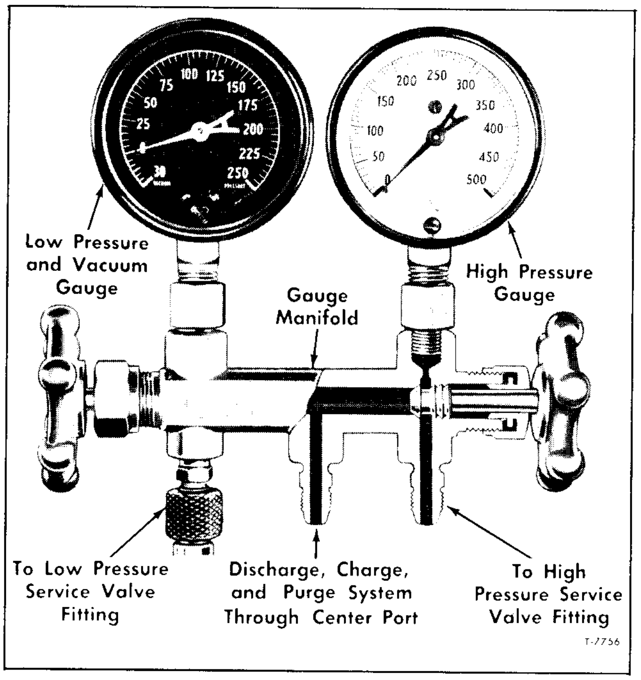

Low Pressure and Vacuum Gauge
Gauge Manifold
High Pressure Gauge
To Low Pressure Service Valve Fitting
Discharge, Charge, and Purge System Through Center Port
To High Pressure Service Valve Fitting
T-7756

Figure 71—Refrigerant Pressure Gauge Set (Typical)

receiver. With the level ABOVE the sight glass, the line between the liquid and the vapor is not visible and it would be easy to read this as a LOW condition.

> BE SURE YOU KNOW WHERE THE LEVEL IS BEFORE YOU ADD REFRIGERANT. IT IS NOT NECESSARY TO ADD REFRIGERANT IF THE LIQUID LEVEL IS VISIBLE IN THE SIGHT GLASS.

USING REFRIGERANT PRESSURE GAUGE SET

The gauge set shown in figure 71 is one tool that is definitely essential for servicing the air conditioning system. It is used when charging, evacuating and for diagnosing trouble in the system.

Gauge set can be obtained through a local refrigeration sales and service dealer.

The pressure gauge unit at the left side of set is the low pressure gauge with face graduated in pounds of pressure from 0 to 250 in 5-pound graduations; and in the opposite direction in inches of vacuum from 0 to 30 inches.

THIS GAUGE UNIT MUST ALWAYS BE USED IN CHECKING PRESSURE ON LOW PRESSURE SIDE OF SYSTEM.

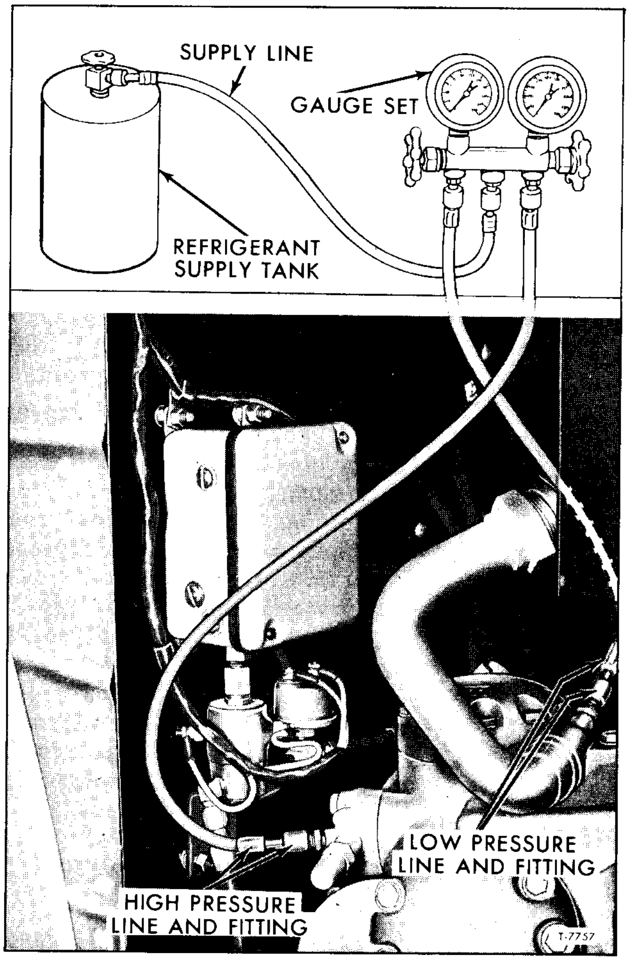


Figure 72—Charging Refrigerants System (Typical)

The pressure gauge unit at right side of set is the high pressure gauge with face graduated in pounds of pressure from 0 to 500 in 5-pound graduations.

THIS GAUGE SET SHOULD ALWAYS BE USED IN CHECKING PRESSURE ON HIGH PRESSURE SIDE OF SYSTEM.

The three line fittings at bottom of gauge manifold are for purpose explained in figure 71.

NOTE: When center line is not being used, cap the connected line or the line fitting.

The hand shut-off valves do not have anything to do with opening or closing off pressure to the gauges. They merely close each opening to the center connector and to each other.

IMPORTANT: When gauge set is being connected to system, which is charged, the gauge lines must always be purged. Purging is accomplished by "cracking" each valve on the gauge set to allow pressure of the system refrigerant to force air to escape through center manifold fitting. Failure to purge lines will result in air or other contaminants entering the system.

NOTE: To prevent gauges from getting out of calibration, handle carefully, and when not in use store gauge set in a safe place.

CHARGING THE SYSTEM

ADDING SMALL QUANTITIES OF REFRIGERANT TO SYSTEM

NOTE: Before adding any refrigerant to system, make sure all leaks have been repaired. Also level out the system by operating the system for 10 to 20 minutes at approximately 1500 engine rpm.

1. Refer to figure 72, which shows lines and gauge set properly installed. Install gauge set to test gauge fittings as shown.

> CAUTION: Valves at compressor should be backseated before removing valve caps and connecting test gauge lines. After connecting lines, open valves 1/4 to 1/2 turn and purge gauge lines.

Connect refrigerant tank charging line loosely to center fitting of gauge manifold. Purge air from refrigerant supply line, then retighten line fitting.

2. Open valve on low pressure side of gauge manifold. Make sure valve on high pressure side is closed.
3. Open vapor valve on refrigerant tank. Support refrigerant tank in an upright position as shown in figure 72 then have an assistant start and operate the system at approximately 1500 engine rpm. Refrigerant will be drawn into the system. Operate the system until refrigerant liquid in receiver tank appears at bottom of sight glass (fig. 15). Check oil level in compressor sight glass. Heat load should be applied during leveling off, so that all oil will return from system to compressor.
4. Close refrigerant tank outlet valve, and remove line and gauge equipment. Install protector caps on test gauge fittings at compressor valves.

CHARGING AN EMPTY SYSTEM

A system which has been evacuated can be charged in same manner described above for "Adding Refrigerant to System." However, if compressor cannot be operated, refrigerant can be transferred from refrigerant tank to system as directed above until refrigerant "HI-LO" pressure switch cuts in and compressor starts to operate. Continue to add refrigerant to system by performing Steps 3 and 4 under "Adding Refrigerant to System."

REMOVING EXCESS REFRIGERANT

(Returning to Supply Tank)

NOTE: To avoid the possibility of removing compressor oil along with the refrigerant by exhausting the refrigerant at gauge service fittings, it is recommended that the refrigerant be exhausted from the top of compressor suction valve. Do not operate system when removing refrigerant.

> CAUTION: When transferring refrigerant from air conditioning system to a tank, make sure tank is not filled beyond its rated capacity by weight.

1. Install refrigerant gauge set to test gauge fittings (fig. 72). Make sure gauge valves are closed.
2. An empty or partly empty refrigerant drum should be connected with hose to center fitting of gauge set. Purge air and moisture from connecting hose.
3. Pack refrigerant supply tank in ice or run cold water over tank until temperature of tank is reduced and pressure in tank is maintained well below the pressure in system.
4. Open valve at top of refrigerant supply tank. Slowly open low pressure valve on gauge set and permit refrigerant to enter supply tank.

NOTE: The rate of refrigerant removal will be determined by the ambient temperature and by the coolness of refrigerant supply tank.

5. After a short period of time, close valves on gauge set and supply tank, then start and operate system until it levels out (10 to 20 minutes at approximately 1500 engine rpm). Check refrigerant level on receiver tank sight glass as previously instructed under "Checking Refrigerant Level."
6. If necessary, repeat refrigerant removal procedure. If too much refrigerant was removed, warm refrigerant supply tank, open valve on supply tank and low pressure valve on gauge set. When refrigerant raises to proper level, close valves on supply tank and gauge set.
7. Shut down system. Disconnect gauge set, install protector caps over test gauge fittings.

PUMPING DOWN THE SYSTEM

In order to accomplish certain operations on the system which necessitate disconnecting refrigerant lines, it is necessary to first pump down the system to prevent appreciable loss of refrigerant. To pump down the system means to pump most of the refrigerant into the liquid receiver tank.

1. Connect gauge set to test gauge fitting as shown in figure 72.
2. Operate compressor for 10 or 15 minutes to permit the system to level out, then with compressor still running, close the discharge valve on the liquid receiver tank by turning the valve stem in until the valve seats.
3. Continue to operate compressor at approximately 1600 engine rpm, until low pressure switch stops it, observing pressure on gauge.
4. When suction pressure builds up to low pressure switch cut-in (30 pounds - after approximately 5 minutes), again start compressor and run until it again cuts out.
5. Close receiver tank and compressor inlet valves by turning clockwise to full "OFF".
6. Do not close compressor outlet valve. High pressure test gauge connected to this valve is reading actual pressure of refrigerant in compressor, condenser, and lines, leading to and from condenser. This refrigerant cannot be pumped down but must be released before opening the system.
7. Remove center hose from the test gauge set and open valve slowly on high pressure side of set. This will allow remaining refrigerant in the condenser and lines to escape to atmosphere.
8. When indicator on high pressure gauge drops to zero, refrigerant lines on either low or high side may be safely removed. The only unit now containing refrigerant is the sealed-off liquid receiver tank.

IMPORTANT: If lines to be opened to atmosphere are colder than the ambient air temperature, a considerable amount of sweating will take place on inside of lines. ALWAYS ALLOW REFRIGERANT PIPING AND UNITS TO WARM UP TO THE AMBIENT AIR TEMPERATURE BEFORE OPENING SYSTEM.

EVACUATING THE SYSTEM

Evacuating the system means to place a vacuum on the refrigerant system for the purpose of removing air and moisture. Moisture and air can chemically react with the oil and refrigerant to form acid and sludge in the oil, copper plating and corrosion in the compressor and to generally reduce the system effectiveness. Moisture in the system can cause either freezing at the expansion valve or a formation of acid which is definitely detrimental to internal parts of the compressor. Air in the system will cause high head pressure and reduce the cooling capacity.

Evacuation is necessary whenever the system is exposed to atmospheric conditions, or when air and/or moisture is present in the system. Some common causes of contamination are:

1. System open for hose, compressor or other component replacement.
2. Complete loss of refrigerant charge caused by a leak.
3. Improper precautions when charging system with refrigerant or oil including the use of refrigerant salvaged from a contaminated system or oil which is improperly stored.

The longer the system remains open, the more critical is the problem of contamination due to condensation occurring inside the system. If the system must remain idle for several hours, capping of open lines and charging with enough refrigerant to partially pressurize the system will minimize contamination and the time required for evacuation later.

In case of emergency, where a vacuum pump is not available, the system may be purged with refrigerant to eliminate air in the system. This should only be done in an emergency.

Evacuation of a system to 2 mm Hg (2 millimeters of mercury, absolute pressure) will minimize air contamination. If the system can maintain this pressure after the evacuation pump is removed, it can be assumed to be relatively free of moisture. A rise in pressure after the vacuum pump is removed indicates that a leak is present, or that moisture is present and is boiling. If this condition exists, refer to Step 7 under "To Evacuate and Charge the System" later.

The following equipment is essential in evacuation. A good vacuum pump, vacuum lines, and vacuum valves can substantially reduce labor hours, equipment down time, and improve equipment efficiency and life.

Vacuum Pump

A two-stage vacuum pump rated at 5 cfm (cubic feet per minute in free air) and having an efficiency rating of .1 micron Hg (millitor) is acceptable for evacuation (the efficiency rating is sometimes referred to as guaranteed vacuum).

Vacuum Lines

Vacuum rated hose and flared copper tubing should be used to connect the vacuum pump and vacuum gauge to the system.

NOTE: The rubber hoses normally used for refrigerant charging are not suited for vacuum work and should not be used.

Vacuum Valves

A closed-end, U-tube mercury manometer should be used. A five-inch model registering

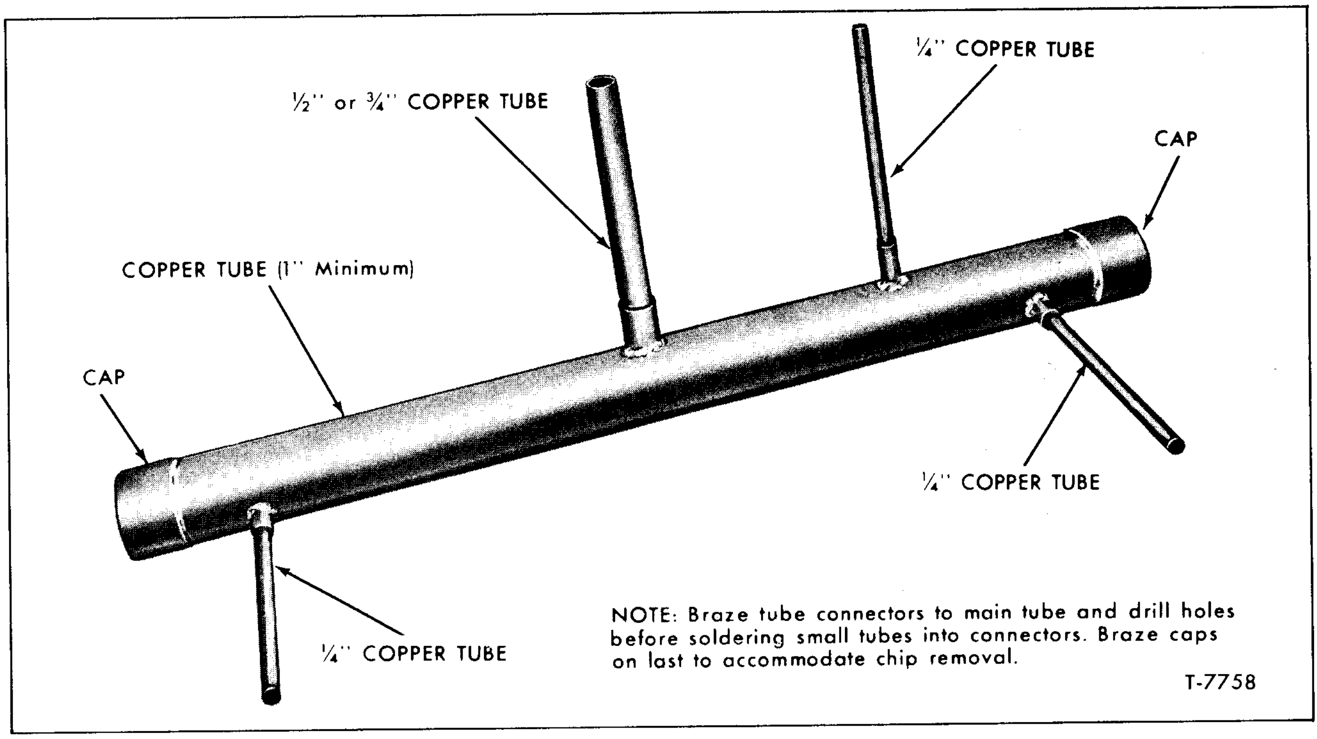

¼" COPPER TUBE
½" or ¾" COPPER TUBE
CAP
COPPER TUBE (1" Minimum)
CAP
¼" COPPER TUBE
¼" COPPER TUBE
NOTE: Braze tube connectors to main tube and drill holes before soldering small tubes into connectors. Braze caps on last to accommodate chip removal.
T-7758

Figure 73—Evacuation Manifold (Typical)

vacuum in the range of 25 to 30 inches of mercury (Hg) which corresponds to 125 to 0 mm. Hg absolute pressure is sufficient.

NOTE: Mechanically actuated vacuum gauges such as are used on the refrigerant pressure gauge set must not be used.

A vacuum rated diaphragm valve should be used to properly isolate the system where shutting off the vacuum pump.

An evacuation manifold set-up is outlined below. This set-up coupled with an adequate vacuum pump, can reduce the evacuation time to a minimum.

Evacuation Manifold:

The biggest factor in reducing evacuation time is reducing the number of internal restrictions within the air conditioning system and evacuation connections. Some restrictions which have been found in many set-ups are:

1. Long, small diameter hoses.
2. Schraeder valves.
3. Expansion valve.
4. Compressor discharge valves and rings.

Heavy wall flexible vacuum hose, made of rubber or plastic polymers, is available in relatively large diameters. By coupling the vacuum pump to the system using this hose, the restrictions of small diameter hoses are minimized.

Schraeder Valves cause severe restrictions to evacuation due to the limited size of the orifice through which the gas must pass. For this reason, the Schraeder Valves should be bypassed when evacuating. This can be done by evacuating at the compressor suction and discharge service valves and removing Schraeder Valve cores in these valves.

Expansion, suction, and discharge valves as well as piston rings cause restrictions within the system which increase evacuation time. These restrictions can be virtually eliminated by evacuating from both "high" and "low" sides of the system.

A suitable evacuation manifold, complete with a 1/4-inch fitting for the vacuum manometer connection, and two 1/4-inch fittings for the discharge and suction line connections is depicted in Figure 73. This manifold can be made of brazed copper tubing. Flared 1/4-inch copper tubing and 1/4-inch flared tube nuts should be used with clamps to adapt the 1/4-inch vacuum hoses to the compressor. The hoses should also be clamped onto the 1/4-inch copper tubes on the manifold. The heavy wall flexible vacuum tubing (1/2-inch I.D. for 5 cfm pumps, and 3/4-inch I.D. for 10-15 cfm pumps) should be clamped onto the 1/2 or 3/4 fitting on the manifold and onto the vacuum side of the vacuum pump. Be sure to have a vacuum rated diaphragm valve on the intake port of the pump to isolate it from the manifold and air conditioning system. Figure 74 shows the evacuation equipment.

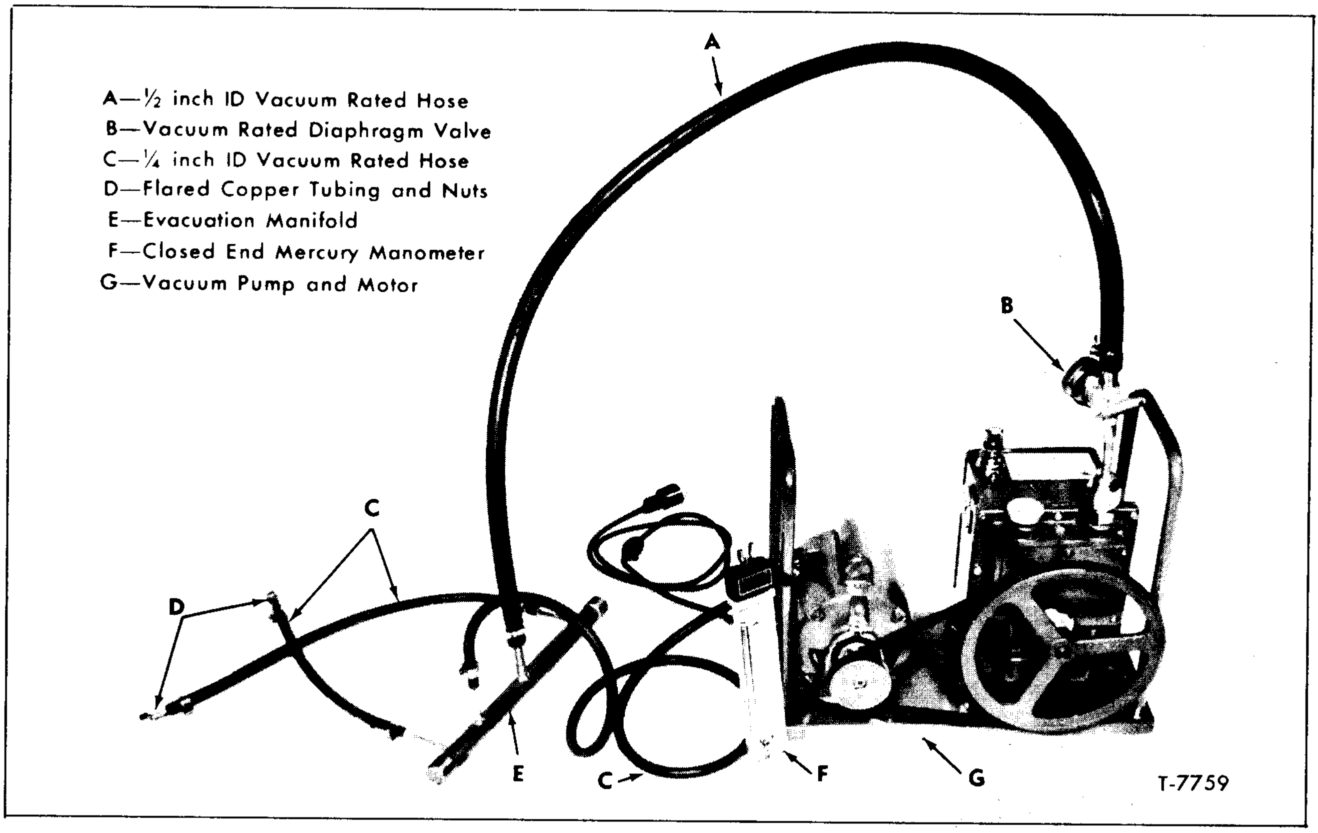

A—½ inch ID Vacuum Rated Hose
B—Vacuum Rated Diaphragm Valve
C—¼ inch ID Vacuum Rated Hose
D—Flared Copper Tubing and Nuts
E—Evacuation Manifold
F—Closed End Mercury Manometer
G—Vacuum Pump and Motor
A
B
C
D
E
C
F
G
T-7759

Figure 74—Evacuation Equipment (Typical)

TO EVACUATE AND CHARGE THE SYSTEM

With the previously prescribed equipment, the following procedure can be followed to evacuate and charge the air conditioning system.

1. Be sure all valves are in operating position.

2. If the system has been contaminated and refrigerant is still present, it should be discharged to the atmosphere by removing the cap from the service valve at the dehydrator strainer and opening the valve. When the refrigerant stops escaping, close the valve.

NOTE: If the system is not contaminated, but must be opened, pump the refrigerant into the receiver tank as explained under "Pumping Down The System" previously.

IMPORTANT: DO NOT ATTEMPT TO SAVE OR REUSE REFRIGERANT WHICH MIGHT BE CONTAMINATED.

3. Back seat the suction and discharge valves on the compressor. Valves are equipped with a plug or a Schraeder fitting. Plugs (Item 2, fig. 75), should be replaced with a 1/4 x 1/8 N.P.T. flared tube connector, and cores should be removed from Schraeder fittings. The connectors should be sealed with a permanent type refrigerant sealant.

4. Attach the flared copper tubes of the two evacuation lines to the connectors as explained in step 3. Open the valves three full turns but do not allow the valves to front seat (fig. 75). Replace caps (Item 4, fig. 75) to prevent leaks.

5. Attach the mercury manometer vacuum gauge to the manifold using the same type of vacuum rated tubing and clamps used to link the manifold to the compressor.

NOTE: Charging hose is not recommended for either application.

6. Be sure the diaphragm valve on the vacuum pump is open, and start the pump. The pump should be operated long enough to create a pressure reading of 2 mm Hg, at which time the diaphragm valve should be closed and the pump turned off. DO NOT TURN OFF PUMP until after the diaphragm valve has been fully closed.

7. Allow the system to stand idle for ten minutes or until a rise in pressure of 5 mm is noted, whichever occurs first. If a pressure rise is noted, start the pump, open the diaphragm valve, and again reduce the pressure to 2 mm. If after this has been done three times the vacuun will still not hold, close the diaphragm valve, add a partial charge of refrigerant to the system (steps 8 and 9) and check for leaks. Be sure to check the manifold, gauges, and pump (a trace

of refrigerant from the pump indicates a leaking diaphragm valve). After leak is found and fixed, re-evacuate as before.

8. Using the gauge manifold set, attach the center hose to the refrigerant supply tank and the low pressure hose loosely to the service valve fitting at the dehydrator. The high pressure gauge valve should be closed and the low pressure gauge valve should be open on the gauge set. Slowly open the "GAS" valve on the supply tank allowing refrigerant to escape at the dehydrator service valve connection. Tighten the connection on the service fitting when all the air has been purged from the charging lines.

9. Back seat the suction and discharge valves to protect the mercury manometer from sudden changes in pressure. Break the vacuum by VAPOR charging the system to 50 psi. Liquid charging will cause too rapid an increase. Check the pressure at the charging port by using the low pressure gauge of the gauge manifold set. The supply tank valve will have to be closed momentarily after short intervals to determine the pressure in the system. Close the charging valve at the dehydrator when 50 psi has been reached. If leaks were suspected in Step 7, check for them now and return to Step 6.

CAUTION: Excessive pressure and/or liquid charging can create the hazard of frostbite to the mechanic when changing the dehydrator and should be avoided.

10. The dehydrator must be changed each time the system is evacuated after air-moisture contamination has occurred. With the pressure increased to 50 psi, slightly loosen both attaching nuts to the dehydrator using TWO (2) WRENCHES to avoid twisting the lines (see Fig. 77). As rapidly as possible, to avoid total loss of refrigerant pressure, remove the dehydrator from the line, remove sealing caps from a new dehydrator and install the new unit in the line. Test for leaks at the dehydrator using additional refrigerant if necessary to maintain at least 50 psi in the system.

11. Due to the possibility of small amounts of air and moisture entering the system during the previous Step, the system should be re-evacuated to 2 mm Hg (the vacuum pump diaphragm valve and compressor suction and discharge valves must be reopened, and the dehydrator service valve shut off). When the system has been evacuated and checked for ten minutes, back seat the suction and discharge valves and remove the evacuation manifold. Replace plugs and cores removed in Step 3. Slightly off seat valve and be sure to replace caps, Item 4, Figure 75, tightly over valve stem. Check for leaks.

12. After weighing the refrigerant supply tank so that the amount of refrigerant added to the system can be controlled, remove the center hose from the gauge manifold set, and connect the hose loosely at the dehydrator service fitting. After purging the line, place the supply tank valve in the LIQUID charging position and open the service fitting at the dehydrator line. This will allow direct liquid charging to the receiver tank. Monitor the weight of the supply tank to determine when a full charge of refrigerant has been added to the system (23 pounds). The system should be capable of pulling nearly a full charge of liquid refrigerant with the vacuum in the system.

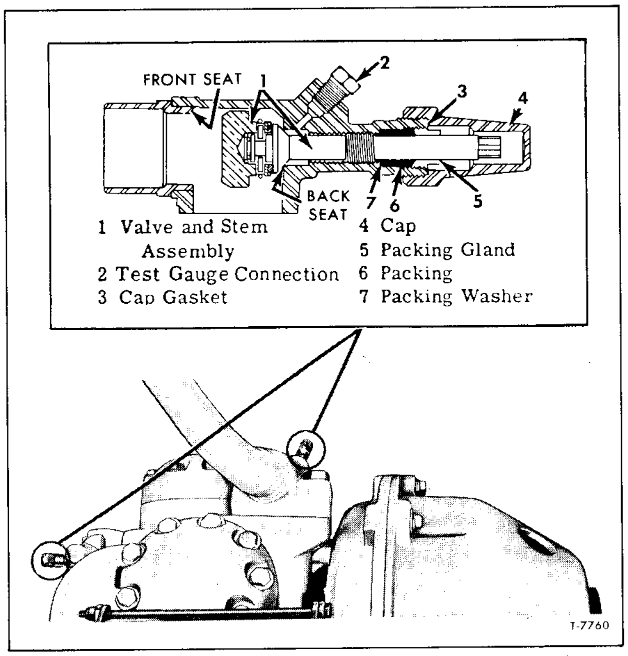


Figure 75—Evacuation Points at Compressor

13. If less than a full charge of refrigerant was added to the system in Step 12, close the discharge valve on the receiver tank, open the charging valve at the dehydrator, and operate the A/C system at engine idle until the balance of the liquid charge is added. Close the dehydrator service valve and supply tank valve and shut off the A/C system. Carefully loosen charging line to allow liquid refrigerant to escape SLOWLY to prevent frostbite. Remove the charging line and check for leaks. Be sure to open the receiver tank discharge valve before further operating the system.

14. If the air conditioning system is to be charged with refrigerant without the use of scales, the refrigerant supply tank should be connected to the system and the charging line purged the same way as outlined in Step 12. A partial charge of liquid refrigerant should be added to the system and the service valves at the dehydrator closed. The air conditioning compressor should

then be allowed to operate for five minutes at 800 engine rpm, at which time the receiver tank outlet valve should be closed and the service valve should again be opened for no longer than two minutes. The service valve should then be closed, the receiver outlet opened, and the system allowed to operate five more minutes to determine whether or not a half sightglass of refrigerant has been charged. Continue this procedure until the one-half sightglass charge has been added.

CHECKING FOR AIR IN SYSTEM

Air in refrigerant system causes excessive head pressures and excessively high operating temperatures. Check for air in system as follows:

1. Connect an accurate pressure gauge to high pressure test gauge fitting.
2. Hang an accurate thermometer near intake side of condenser coil.
3. Allow compressor to stand idle for several hours to allow temperatures of all parts to equalize, then note reading on thermometer and reading on gauge.
4. Compare these figures with figures shown in "Pressure Temperature Chart" on page 138. If pressure gauge shows a reading of more than 3 pounds higher than pressure shown on chart for the existing temperature, air must be purged from system.

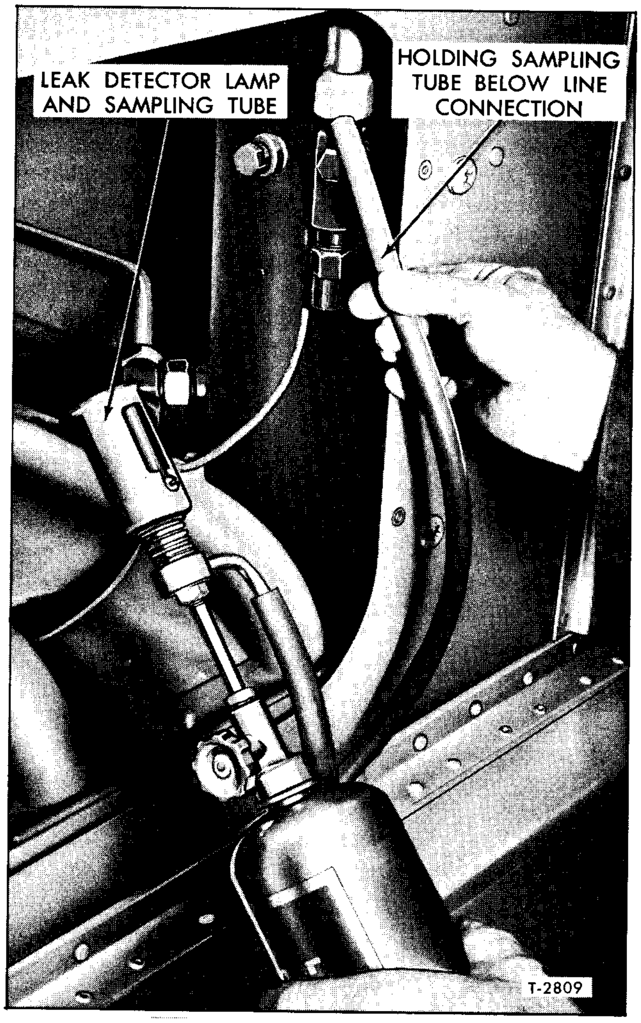

LEAK DETECTOR LAMP AND SAMPLING TUBE
HOLDING SAMPLING TUBE BELOW LINE CONNECTION
T-2809

Figure 76—Testing for Refrigerant Leaks

PURGING AIR FROM SYSTEM

If it is determined that air is present in system as previously described under "Checking For Air In System." If moisture is indicated, evacuate the system and recharge with new refrigerant as instructed under applicable headings in this section. If moisture is not indicated, purge air from system as follows:

1. Place refrigerant valves in open position to admit refrigerant to entire system.
2. To purge air from system, loosen line connection at top of condenser coil. After a small amount of refrigerant gas and air has escaped, tighten connection.
3. Recheck for air in system as previously directed and repeat procedures as required.

SUPERHEAT CHECK

Instructions for checking superheat are explained previously under "Expansion Valve" in "SYSTEM MAINTENANCE" section of this group.

TESTING FOR REFRIGERANT LEAKS

Whenever repairs or adjustments have been made to any part of the refrigerating system which necessitate disconnecting refrigerant lines or make it necessary to add refrigerant to the system, connections should be tested for leakage before the system is restored to service. Admit enough gas into the system to produce 100 pounds pressure, then test for leaks (fig. 76), using a leak detector. All leaks may be indicated by oil seepage and must be repaired immediately.

REFRIGERANT LEAK DETECTOR

Refrigerant leak detector, commonly called a Halide Lamp, is a small torch which may burn alcohol, propane or acetylene. Air used in the burner is drawn through a flexible sampling tube. Operation of leak detector is as follows:

Observe color of flame when clear air is being drawn through the sampling tube. Color of flame may vary depending on type and grade of fuel used in the burner.

By holding open end of sampling tube under connections, joints, valves, etc. (fig. 76), any

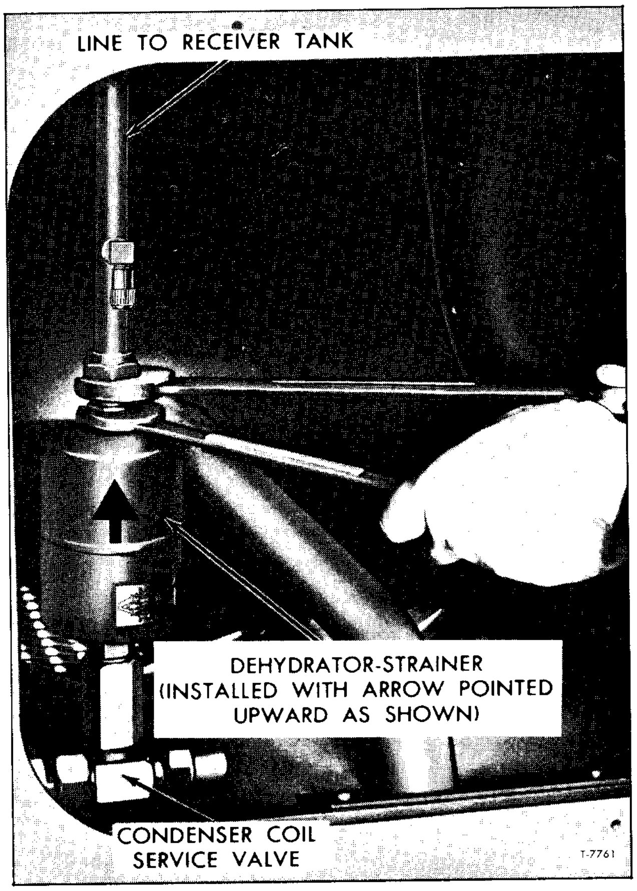

LINE TO RECEIVER TANK
DEHYDRATOR-STRAINER (INSTALLED WITH ARROW POINTED UPWARD AS SHOWN)
CONDENSER COIL SERVICE VALVE
T-7761

Figure 77—Replacing Dehydrator Strainer

traces of refrigerant would be drawn through the tube to the burner and would be immediately evident by the change in color of the flame. Refrigerant breaks down when coming in contact with the heated copper ring in burner and changes the color of the flame. Do not confuse change in color with change caused by shutting off air supply in holding end of sampling tube too close to some object. Color of flame will vary from a light trace of green with a very small leak to a dark blue with a large leak.

NOTE: Compressor crankshaft seal can be checked for leakage by inserting end of detector tube into hole at bottom of clutch housing when compressor is not operating.

Instructions are supplied with leak detector and should be carefully observed.

When refrigerant has been lost, adding refrigerant without knowing cause or location of leak merely postpones corrective measures and increases maintenance costs. Check for leaks at all joints and connections throughout the system whenever refrigerant must be added.

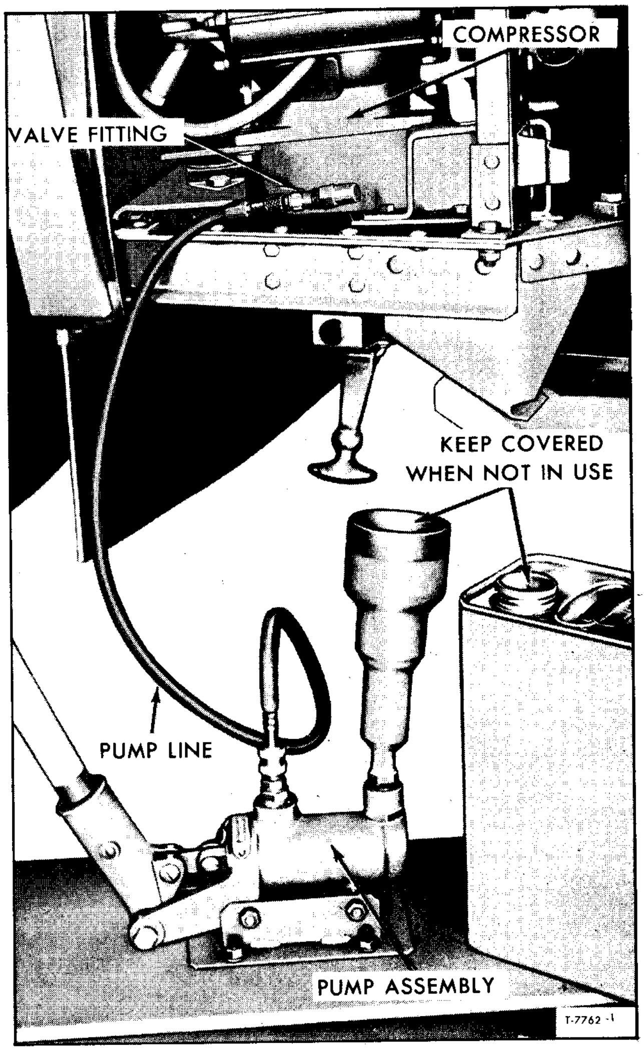


Figure 78—Adding Oil to Compressor Using Hand Pump

REPLACING DEHYDRATOR-STRAINER

Replace dehydrator-strainer as follows:

1. Close receiver inlet and condenser coil service valves (fig. 15). Loosen exhaust port cap.
2. Referring to figure 77, remove old unit in manner shown.

CAUTION: DO NOT twist refrigerant lines, use two wrenches as shown.

3. Remove old unit from refrigerant line, then remove sealing caps from new unit and IMMEDIATELY thread unit into liquid line. Tighten connections firmly.
4. Crack condenser coil service valve but leave receiver inlet service valve closed.
5. Allow refrigerant to exhaust until satisfied that all contaminated refrigerant has been exhausted from between the two valves.

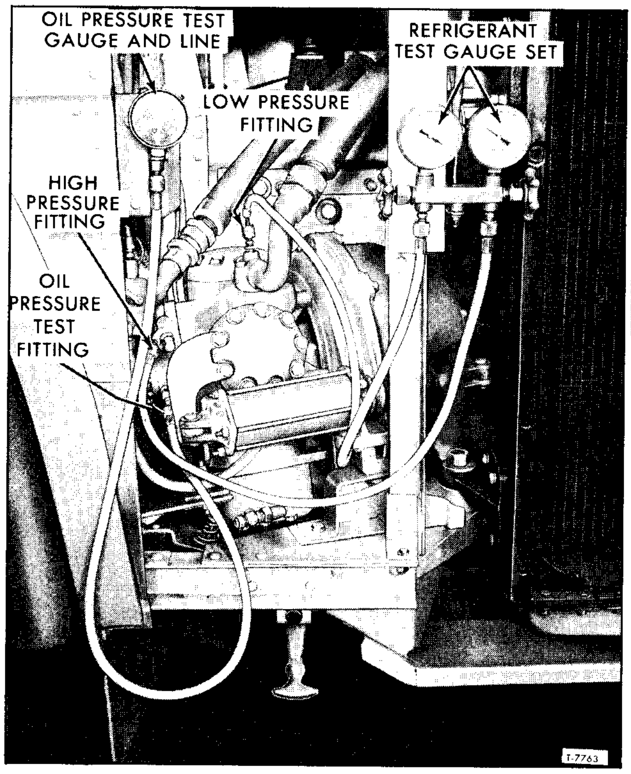

OIL PRESSURE TEST GAUGE AND LINE
REFRIGERANT TEST GAUGE SET
LOW PRESSURE FITTING
HIGH PRESSURE FITTING
OIL PRESSURE TEST FITTING
T-7763

Figure 79—Checking Compressor Pump Pressure

6. Tighten cap firmly, then open inlet service valve (fig. 15) and condenser coil service valve from front port of receiver inlet valve.

7. Test for leaks at all connections using a Halide Torch. Refer to "Testing For Leaks" explained previously.

REFRIGERANT VALVES

Before operating air conditioning system after storage or inactive period and during operation of system, refrigerant valves must be in "Open Position." When system has been pumped down and is being prepared for operation, open valves in the following sequence:

1. Receiver Tank Liquid Out Valve - Fully Open. Stem turned counterclockwise.
2. Compressor Suction Valve - Fully Open (Backseated), then turn off from backseated position 1/4 - 1/2 turn.
3. Compressor Discharge Valve - Fully Open (Backseated), then turn off from backseated position 1/4 - 1/2 turn.
4. Receiver Tank Inlet Valve - Fully Open.

SERVICING COMPRESSOR OIL CHARGE

The initial charge of oil in the compressor is 5.3 pints. Oil level in compressor is observed through sight glass at side of compressor. Oil level should be checked after system has been in operation at approximately 1500 engine rpm for 45 to 60 minutes. Level should be 1/2 to 3/4 way up on sight glass.

If oil is to be added, use special wax free dehydrated refrigerant type oil as specified under "Compressor Oil" in "AIR CONDITIONING LUBRICATION AND INSPECTION" later. Oil should be obtained in sealed cans. Never use oil which has been exposed to air for any length of time.

ADDING OIL TO A CHARGED SYSTEM

NOTE: Compressor oil is added to compressor by means of a pump connected to the oil charging valve at bottom of compressor handhole cover as shown in figure 78.

With system leveled out (system operated for 45 to 60 minutes at approximately 1500 engine rpm) add oil as follows:

1. Stop compressor then remove protector caps from valve stem on compressor sump.

2. Connect pump supply line loosely to valve fitting. Fill reservoir of pump with recommended oil, then after all air bubbles have vanished, operate pump to purge air from line to compressor valve. Tighten connection at compressor valve.

3. Open compressor valve by turning stem counterclockwise.

4. Operate pump SLOWLY while checking oil level on compressor sight glass.

IMPORTANT: Keep pump reservoir near full at all times to prevent air from being pumped into system.

Add oil until level is 1/2 to 3/4 way up on sight glass. Close valve at base of compressor, then remove charging equipment.

5. Install protector caps over stem and line fitting of compressor oil pressure test fitting valve.

DRAINING EXCESS OIL FROM COMPRESSOR

NOTE: Compressor should be operated for at least 1/2 hour before draining to allow separation of oil and refrigerant.

1. Remove protector caps from stem and line fitting of valve located at end of compressor.

2. Connect flexible hose to valve fitting, then open valve slowly by turning stem counterclockwise. Allow oil to flow into suitable container.

NOTE: Special care should be taken when removing oil because of oil foaming. The foaming makes it difficult to determine the amount of oil being removed. Recheck compressor oil level. Close the valve and install protector caps after draining.

CHECKING COMPRESSOR OIL PUMP PRESSURE

To assure proper operation of the compressor, the compressor oil pump must supply the proper oil pressure. The compressor oil pump pressure check is made by subtracting the refrigerant suction pressure reading from the pump pressure reading. The minimum oil pressure reading allowable on pump gauge is 35 psi at 500 rpm engine speed.

Make Check as Follows:

1. Connect refrigerant test gauge to low pressure test gauge fitting (fig. 79).

NOTE: For this particular check it is not necessary to connect the gauge set high pressure line to compressor discharge or high pressure fitting as shown.

2. At side of compressor, install oil pressure gauge and hose to compressor oil pressure gauge fitting as shown.

3. Start engine and operate system for 20 minutes at 500 engine rpm, then check refrigerant suction pressure reading and the pump pressure reading while system is still operating. If refrigerant suction reading is 35 and the oil pump pressure reading is 60, subtract 35 from 60 which leaves 25 psi, the actual pump pressure. If oil pump pressure is below minimum specified, replace compressor pump. The compressor will fail to function properly unless sufficient oil pressure is available.

CONDENSER FAN SPEED CHECK

Check condenser fan motor at both high and low speed conditions with engine running at fast idle as follows:

1. Connect a tonge ammeter gauge around the 2-gauge red lead at the condenser fan magnetic switch and note the reading. Ammeter reading should be 83 ± 8 amps on high speed and 48 ± 8 amps on low speed.

2. Connect ammeter across the 16-gauge (yellow-red tracer) lead at the condenser fan high speed relay and note the reading. Ammeter should register 4.5 ± 1.0 amps on high speed and 9.5 ± 1.0 amps on low speed.

NOTE: Condenser fan motor checks must be made with the condenser intake area uncovered.

3. If fan motor fails to operate, check the following:

a. "HEAT-AIR COND." switch not in "AIR COND." position.

b. Low system voltage; condenser fan magnetic switch not operating.

c. No ground strap on condenser fan motor.

d. The 90-AMP circuit breaker has operated or failed open.

4. If fan motor operates only at low speed, check the following:

a. Failure of the high speed pressure switch to operate, contacts remain open. Check switch setting which should be 325 ± 5 psi with a differential setting of 30 ± 5 psi.

b. Condenser fan high speed relay not energized, contacts remain closed. Check for poor or no ground on the relay.

c. High speed resistor shorted out.

5. If fan motor operates only at high speed, check the following:

a. High speed pressure switch remains closed.

b. Condenser fan high speed relay is not returning to the normally closed position. Check for poor or no ground at relay.

Trouble Shooting

Most any trouble in the air conditioning system will produce the same symptoms - insufficient cooling.

The following, which is more of a quick reference chart, deals with locating and correcting the common causes of insufficient cooling.

NOTE: Detail trouble shooting information of a specific condition, the possible causes of a condition, its symptoms and the recommended action to be taken is shown later on "Trouble Analysis Chart" page 189.

IMPORTANT

THE MOST COMMON CAUSE OF INSUFFICIENT COOLING IS A DIRTY, CLOGGED CONDENSER COIL. THIS CONDITION SHOULD BE CHECKED FREQUENTLY AND CORRECTED AS EXPLAINED ON PAGE 189.

CONDITION	REMARK
1. Underfloor Blower Not Running	
(a) Loose Electrical Connections	Tighten
(b) Defective Relay	Replace - Page 128
(c) Defective Blower Motor	Repair
2. Dehydrator - Strainer Clogged	Replace - Page 185
3. Underfloor Air Filter Screen Clogged	Page 140
4. Compressor Valves Not in Operating Position	Page 146
5. Improper Engine Idle Speed	
6. Low Refrigerant	
(a) Leaks in System	Page 184
(b) Recharge System	Page 182
7. Expansion Valve Inoperative	
(a) Capillary Tube Broken	Page 135
(b) Equalizer Tube Restricted	Page 136
(c) Gummed Cage	Page 135
(d) Check for Proper Superheat	Page 136
(e) System Short of Capacity	See "Trouble Analysis Chart" - Page 189
8. Compressor Clutch Disengaged or Fails to Engage	
(a) Dirty Condenser	Page 177
(b) Too Much Refrigerant	Page 179
(c) Air in Refrigerant System	Page 184
(d) Insufficient Air Pressure for Clutch Operation	Page 160
(e) Air Leaks in Clutch Operating System	Page 160
(f) Worn Clutch Plates	Replace - Page 164
(g) Refrigerant Valves Not in Operating Position	Page 146
(h) Dehydrator-Strainer Plugged	Replace - Page 185
(j) Defective Clutch Control Air Cylinder	Page 168
(k) Defective Clutch Control Air Solenoid Valve	Page 133
(l) Faulty Clutch Adjustment	Page 160
9. Compressor Clutch Disengages or Fails to Engage at High Outside Temperatures (Items a, b, and c above will cause this condition).	

TROUBLE ANALYSIS CHART

This Trouble Analysis Chart is to supply information for trouble-shooting a specific condition, affected mostly by the operation of the refrigerant compressor. It also contains information on conditions affecting pressures within the refrigerant system.

CONDITIONS OR COMPLAINTS

NOTE: Reference note numbers listed under each specific condition or complaint refer to information on the possible causes, the symptoms, and also recommendations for making correction. See designated notes below:

Compressor Fails to Start
(See NOTES: 1, 2, 3, 4, 5, and 6)

Compressor "Short Cycles"
(See NOTES: 8, 9, 10, 11, 12, 13, 14 and 15)

Compressor Loses Oil
(See NOTES: 14, 16, 17, 18, 19, 20 and 21)

Compressor is Noisy
(See NOTES: 16, 19, 22, 23, 24, 25 and 26)

Refrigerant Discharge Pressure Too High
(See NOTES: 12, 15, and 30)

Refrigerant Discharge Pressure Too Low
(See NOTES: 13, 31, and 32)

Refrigerant Suction Pressure Too High
(See NOTES: 25, 32, 33, 34, 35 and 36)

Refrigerant Suction Pressure Too Low
(See NOTES: 11, 13, 14, 37, 38, and 39)

System Short of Capacity
(See NOTES: 11, 14, 25, 27, 28, and 29)

NOTES

	Possible Cause	Symptoms	Recommendations	Reference
NOTE 1	Frozen compressor due to locked or damaged mechanism.	Compressor is noisy or will not operate.	Overhaul compressor.	See page 149.
NOTE 2	Broken or sheared compressor drive shaft.	Excessive noise at engine or compressor not operating.	Repair or properly connect drive shaft.	See page 160.
NOTE 3	Clutch drive plate is worn or saturated with grease.	Slipping action. Odor or smoke in compartment.	Replace clutch plate. Check and adjust clutch control air cylinder push rod travel.	See page 164.
NOTE 4	Defective clutch control air cylinder or improper linkage adjustment.	Slipping action. Odor or smoke in compartment.	Check and adjust air cylinder push rod travel.	See page 161.
NOTE 5	Insufficient air pressure for clutch operation.	Slipping clutch. Odor or smoke in compartment.	Build up at least 65 psi in air system. Check pressure to air cylinder.	See page 160.
NOTE 6	Defective clutch control air solenoid valve.	Clutch fails to engage.	Check for open circuit to valve. Loose connections. Defective valve.	See page 133.

TROUBLE ANALYSIS CHART (CONT'D)

	Possible Cause	Symptoms	Recommendations	Reference
NOTE 7	Open control circuit. a. Hi-Lo pressure switch defective. b. Engine oil pressure too high (over 15 psi). c. Engine idling too fast (above 600 rpm).	Open circuit to clutch solenoid valve.	Lower engine idling speed. Engine oil pressure must be below 15 psi. Oil may be cold. Check "HI-LO" pressure switch setting.	See page 130.
NOTE 8	Intermittent contact in electrical control circuit. Compressor valves not in operating position.	Compressor intermittently starts and stops.	Repair or replace faulty electrical control. Check for loose wiring connections. Open compressor valves.	See page 146.
NOTE 9	Low pressure switch controller differential set to close.	Frequent starting and stopping.	Check Hi-Lo pressure switch setting.	See page 130.
NOTE 10	High pressure switch controls differential too close.	Frequent starting and stopping.	Replace Hi-Lo pressure switch assembly.	See page 130.
NOTE 11	Dirty or iced evaporator coil.	Reduced air flow: a. Dirty or clogged air filter screen. b. Underfloor blower inoperative. c. Plugged recirculating air ducts.	Clean air filter screen. Check recirculating ducts for obstructions. Check blower motor.	See page 140. See page 140.
NOTE 12	Overcharge of refrigerant or noncondensible gas.	High discharge pressure	Remove excess refrigerant or purge system.	See page 179. See remark No. 7 later.
NOTE 13	Lack of refrigerant.	Too frequent starting and stopping on low pressure control switch.	Repair refrigerant leak and recharge system.	See remark No. 6 later.
NOTE 14	Clogged refrigerant dehydrator-strainer.	Suction pressure too low and frosting at strainer unit.	Replace dehydrator-strainer.	See page 185.
NOTE 15	Faulty operation of refrigerant condensing system.	Compressor cuts off and on from high pressure switch. a. Condenser fan motor inoperative. b. Condenser air inlet or exhaust grille obstructed. c. Condenser coil dirty.	Repair or replace. Remove obstruction. Clean coil.	See page 141. See page 177.
NOTE 16	Insufficient oil.	Oil level too low.	Add proper amount of compressor oil.	See page 186.

TROUBLE ANALYSIS CHART (CONT'D)

	Possible Cause	Symptoms	Recommendations	Reference
NOTE 17	Traps in hot gas and suction lines.	Oil level gradually drops.	Recheck lines for possible traps. Lines may have been repositioned when body repairs were made.	See remarks Nos. 1 and 5 later.
NOTE 18	Loose expansion valve remote bulb.	Excessive cold suction line.	Provide good contact between remote bulb and suction line.	See remark No. 2.
NOTE 19	Liquid flooding back to compressor.	Excessive cold suction line. Noisy compressor operation.	Readjust superheat setting and check remote bulb contact.	See remarks Nos. 2 and 4 later.
NOTE 20	Short cycling.	Frequent starting and stopping of compressor.	See items previously under "Compressor Short Cycling."	
NOTE 21	Compressor leaking oil.	Oil around base and low oil level on sight glass.	Repair oil leak and add proper refrigerant oil.	See page 149.
NOTE 22	Loose compressor drive shaft.	Flange nuts loose.	Tighten bolt nuts.	See page 160.
NOTE 23	Dry or scored compressor crankshaft seal.	Squeak or squeal when compressor is running.	Check oil level. Replace compressor seal.	See page 149.
NOTE 24	Internal parts of compressor broken.	Noisy compressor.	Overhaul compressor.	See page 149.
NOTE 25	Expansion valve stuck in open position.	Abnormally cold suction line. Compressor knocks.	Repair or replace expansion valve.	See remark No. 2 later.
NOTE 26	Compressor hold-down mountings loose.	Compressor vibrates excessively.	Tighten or replace mountings.	See page 146.
NOTE 27	Flash gas in liquid line.	Expansion valve hisses.	Add refrigerant.	See remark No. 6 later.
NOTE 28	Excessive pressure drop in evaporation.	Superheat too high.	Check superheat and reset expansion valve.	See remark No. 4 later.
NOTE 29	Improper superheat adjustment.	Short cycling.	Adjust expansion valve.	See remark No. 4 later.
NOTE 30	Air or non-condensible gas in system.	Exceptionally hot condenser and excessive discharge pressure.	Purge system.	See remark No. 8 later.
NOTE 31	Broken or leaky discharge valves within compressor.	Suction pressure rises faster than 5 lbs. per minute after pressure shut-down.	Remove compressor head, examine valves and if necessary, replace.	See remark No. 9 later.

TROUBLE ANALYSIS CHART (CONT.)

	Possible Cause	Symptoms	Recommendations	Reference
NOTE 32	Leaky relief valve in compressor.	Insufficient cooling.	Replace relief valve.	See page 149.
NOTE 33	Excessive load on evaporator.	Insufficient cooling.	Check for leaks in evaporator compartment. Check air filter screen and blower motor.	
NOTE 34	Overfeeding of expansion valve.	Abnormally cold suction line. Liquid flooding back to compressor.	Check contact of expansion valve remote bulb in suction line well.	See remarks Nos. 4 and 5 later
NOTE 35	Broken suction valves within compressor.	Noisy compressor.	Remove compressor head, examine valves and if necessary, replace.	See remark No. 9 later
NOTE 36	Compressor worn.	Insufficient cooling.	Overhaul compressor.	See page 149.
NOTE 37	Expansion valve power unit has lost charge.	No flow of refrigerant through valve.	Replace expansion valve assembly.	See remark No. 3 later
NOTE 38	Obstructed expansion valve.	Loss of capacity.	Clean or replace expansion valve.	See page 135.
NOTE 39	Too much pressure drop through evaporator coil.	Superheat too high.	Check for plugged external equalizer line at expansion valve.	See page 135.

TROUBLE ANALYSIS CHART REMARKS

REMARK NO. 1 CLOGGED REFRIGERANT DEHYDRATOR-STRAINER (Refer to Fig. 15)

Occasionally the dehydrator-strainer in the liquid line may become clogged with foreign material in the system. When this happens, the liquid line leaving the strainer will feel cooler than the liquid entering. If it is badly clogged, some sweat or frost may appear at strainer outlet.

REMARK NO. 2 REFRIGERANT EXPANSION VALVE STUCK IN OPEN POSITION (Refer to Figs. 11, 12, and 14)

If the expansion valve is stuck in an open position, there will be an excessive amount of sweating on the suction line and compressor crankcase due to the large amount of liquid being passed into the suction line.

REMARK NO. 3 REFRIGERANT EXPANSION VALVE HAS LOST CHARGE (Refer to Figs. 11, 12, and 14)

The power element of expansion valve consists of the remote bulb, capillary tube and the diaphragm, which actuates the valve cage. If this power element is inoperative or has lost its charge, the valve will either maintain an almost closed position or may close completely. Test for an inoperative power element as follows:

a. Stop compressor.
b. Remove remote bulb from well in suction line at end of evaporator coil.
c. Carefully place remote bulb in container filled with ice water.
d. Start compressor.
e. Remove remote bulb from ice water and warm in hand. At the same time check suction line for rapid temperature change which indicates flood-through of liquid refrigerant. If refrigerant floods through valve, power unit is operating properly.

WARNING: Do not flood-back through suction line for too long a period as excessive liquid flood-back could cause severe damage to compressor.

TROUBLE ANALYSIS CHART REMARKS (CONT'D)

REMARK
NO. 4 - REFRIGERANT EXPANSION VALVE IMPROPERLY ADJUSTED (Figs. 11, 12, and 14)

If the expansion valve is adjusted for too low a superheat, too much liquid will be passed into evaporator. The suction line will be normally cold and liquid may slug back to the compressor. If expansion valve is adjusted for too high a superheat, too little liquid will be passed to the evaporator and the suction line will be abnormally warm. Superheat must always be adjusted carefully using thermometer (fig. 14) and suction gauge.

REMARK
NO. 5 - REFRIGERANT EXPANSION VALVE IS OBSTRUCTED (Refer to Figs. 11 and 12)

Foreign material may obstruct the valve port. If the obstruction is small, the resulting operation will be a "hunting" condition which will cause a suction pressure variation of possibly 10 to 14 psi on suction pressure test gauge. If the obstruction is large and only a small trickle of liquid can pass, the compressor will short cycle. If the obstruction holds the valve open during shutdown, liquid will flood back to compressor. This causes liquid slugging to compressor at start-up, which is definitely harmful. Compressor will knock when this occurs. An obstructed expansion valve is usually indicated by a partly warm evaporator and frosting at the evaporator inlet.

REMARK
NO. 6 - SHORTAGE OF REFRIGERANT

There should always be sufficient liquid in the receiver tank (½ to ¾ way up on sight glass) to completely submerge the inlet to the liquid line pipe. If there is a shortage of refrigerant, the liquid level will fall below the inlet to the liquid line and a mixture of gas and liquid will pass into the liquid line. Bubbles will appear in the sight glass, the larger the bubbles the more severe the refrigerant shortage. Frequently there will be a hissing or whistle at the expansion valve. The coil and suction line will be relatively warm while the suction pressure will be low due to little or no liquid being supplied to the evaporator if the shortage is severe.

REMARK
NO. 7 - OVERCHARGE OF REFRIGERANT

An overcharge of refrigerant will cause high head pressure. Liquid will back up in the condenser and decrease the amount of surface available for condensing and as a result the head pressure will rise. In extreme cases, it may rise to a point where the high pressure cut-out switch will stop the compressor. This may result in compressor short cycling.

REMARK
NO. 8 - AIR IN SYSTEM, PURGING

If air or non-condensible gases are present in the system, they will usually tend to move toward and collect at the condenser. The head pressure will rise to a point above the pressure corresponding to the temperature at which the vapor is condensing. In extreme cases, the pressure may rise to a point where high pressure cut-out switch will stop the compressor.

To determine whether or not there is air in the system, the compressor must be allowed to stand idle long enough for the entire system to cool down to the temperature of the surrounding air. After the system has attained the same temperature as the surrounding air, the reading of the head pressure test gauge should not be more than 3 lbs. above the saturation pressure corresponding to the surrounding air temperature. See "Refrigerant, Pressure-Temperature Relationship" chart, page 138.

REMARK
NO. 9 - BROKEN VALVES IN COMPRESSOR

Broken suction valves or broken or leaky discharge valves within the compressor are generally indicated by the suction pressure rising rapidly as soon as the compressor is stopped. If the suction pressure rises faster than 5 lbs. per minute, it is an indication that the compressor discharge valves are not holding. Before the compressor is torn down, however, it should be determined that the pressure rise is not due to a leaky expansion valve.

Air Conditioning, Lubrication, and Inspection

The following tabulation lists lubrication and service points, service required, and the recommended intervals at which these services should be accomplished. These services should be accomplished at more frequent intervals when system is operated under severe conditions such as extremely high temperatures. References in right-hand column refer to page numbers where service procedures are covered, or to Lubrication Notes below for recommended lubricant and proper application.

Item	Service Required	Daily	At Inspection	See Footnote	Refer to
Compressor	Check Oil Level - Add if Required	X			Page 81 (Note 1 below)
	Drain and Refill			(A)	--
	Check Tightness of Mounting Bolts		X		--
Compressor Suction and Discharge Valves	Check Tightness of Mounting Bolts and Valve Caps		X		--
Liquid Receiver Tank	Check Refrigerant Level	X			Page 177
	Check Tightness of Mounting Bolts		X		--
Condenser	Clean Coils as Necessary	X			Page 177
Dehydrator-Strainer	Replace Cartridge			(B)	Page 185
Underfloor Air Filter Screens	Clean and Re-oil		X		(Note 2, pg.195)
Evaporator Coil	Clean		X		Page 139
HI-LO Pressure Switch	Check Adjustment		X		Page 130
Driver's Control Panel	Tighten Connections		X		--
Compressor Drive Propeller Shaft	Lubricate with Hand Gun		X		(Note 3,pg.195)

(A) After initial 200 hours of operation.

(B) Whenever system has been opened.

NOTE 1—COMPRESSOR OIL

A special 500 S.S.U. Refrigerant-type oil having the following physical requirements must be used.

NOTE: Oil must maintain chemical stability and lubricating properties in the presence of Refrigerant-22, resist corrosion, oxidation, foaming, and the formation of gum or tarry deposits.

The oil shall not contain any foreign material detrimental to the performance of the lubricant.

PHYSICAL REQUIREMENTS:

Viscosity @ 100°F., S.S.U. ASTM D445	500 to 540
Viscosity @ 210°F., S.S.U. ASTM D445	50 Minimum
Pour Point °F., ASTM D97	Minus 20 or Below
Floc Test, °F. (no standard method)	Minus 40 or Below
Moisture Content (Karl Fisher re-agent method)	30 PPM Maximum
Aniline Point, °F. ASTM D611	180 to 220
Neutralization Value ASTM D974	0.05 Maximum mg. KOH/gr. Sample
Defoamant	5 to 30 ppm DC200 Fluid

NOTE 2—ODORLESS OIL

Air Filter Screens. Thoroughly clean filter screens, then spray, or dip and let drain, with light odorless oil, such as medicinal white oil.

NOTE 3—GEAR OIL

Compressor Drive Shaft Universal Joints. Apply small quantity of Non-Melting Grease, #2 Grade with extreme pressure properties to three fittings at 3,000 mile intervals. OVER-LUBRICATION AT FRONT FITTING WILL DAMAGE CLUTCH.

Equipment and Materials

The following equipment and materials are required for servicing the Air Conditioning System. This equipment and material can be procured locally or from any reliable Air Conditioning or Refrigeration supply house.

EQUIPMENT

Thermometer With Remote Reading Dial - For use in conjunction with expansion valve adjustment.

Soldering Torch and Cylinder of Gas - For soldering refrigerant line fittings.

Oil Pressure Gauge - For checking compressor oil pump pressure.

Leak Detector - For detecting refrigerant leaks.

Vacuum Pump - For evacuating the system. Must be capable of producing ultimate vacuum of less than 1MM Hg. absolute.

Test Gauge Fitting Hose Adapters - For adapting service refrigerant hoses to gauge fittings (J-9459 Adapter and J-12148 Adapter Gasket).

Vacuum Gauge - For checking ultimate vacuum during evacuation. Must be readable to 1MM Hg. absolute.

Hand Oil Pump - For adding oil to a charged system.

Pressure and Vacuum Gauge Set - For checking Refrigerant-22 system operation.
- With compound gauge:
  - 0 to 30" vacuum scale.
  - 0 to 250 lbs. pressure scale.
- With high pressure gauge:
  - 0 to 500 lbs. scale.

MATERIALS

Fuel - For use in leak detector.

Refrigerant-22 - Monochlorodifluoromethane. Do not use any other type of refrigerant in this system. (Approximately 23 lbs. required in system, available in various size containers.)

Solder - 95% tin and 5% antimony - For soldering refrigerant line fittings.

Nokorode Soldering Paste - For use on soldered fittings.

MODEL "G" REFRIGERANT COMPRESSOR RECOMMENDED WEAR LIMITS AND TOLERANCES

PART NAME	ORIGINAL SPECIFICATION	RECOMMENDED LIMIT	RECOMMENDED MAXIMUM OIL CLEARANCE
Main Bearings	1.7500 - 1.7505	1.7525	.0055
Crankshaft - Main	1.7485 - 1.7480	1.7465	
Conrod - Crankpin	1.5000 - 1.5005	1.5030	.007
Crankshaft - Crankpin	1.4985 - 1.4980	1.4955	
Piston Pin	.7497 - .7495	.7490	.0011
Conrod - Pin Bore	.7500 - .7505	.7510	
Cylinder Liner	2.1250 - 2.1255	2.1270	.0065
Piston (Perpendicular to Centerline of Pin Bore)	2.1210 - 2.1205	2.1190	
Piston Rings (Gap in 2.1250 Ga.)	.003 - .008	(.030 Compression Rings)	
Valves (All)	Valves are .034"-.036" thick - should be replaced when seat grooves wear depth exceeds .010" (.016" thinnest section).		
Valve Springs (All)	Whenever compressor is disassembled for servicing, valve springs should be replaced when they have operated in excess of 3000 hours.		
Shaft Seal	Replace when leaking or when compressor is overhauled.		

NOTE 1 - The above recommended wear rates are for individual parts. For mating parts the maximum recommended oil clearance should predominate. In most cases, this means that each mating part should not be at the recommended limit.

NOTE 2 - The above recommended limits are listed as good practice for normal service rebuilding of compressors which will be reliable when returned to service. It is not necessary to rebuild a compressor when these limits are anticipated.

SPRING DIMENSIONS

ITEM	ORIGINAL SPECIFICATION
SAFETY HEAD SPRINGS	1.613 - 1.573
SUCTION SENSING SPRING	1.095 - 1.080

MODEL "G" COMPRESSOR BOLT TORQUES

ITEM	TORQUE - FT.-LBS.
Cylinder Head Bolts - 3/8" - 16 x 1-3/4"	20
Discharge Valve Cage Bolt Nut	28
Handhole Cover Bolts	20
Suction Service Valve Bolts - 1/2" - 13 x 2"	45
Connecting Rod Bolts	5
Seal Cover Bolts - 3/8" - 16 x 3/4"	20
Oil Pump Bolts	6
Pump - End Bearing Head Bolts - 3/8" - 16 x 1"	20
Discharge Service Valve Bolts - 5/16"-18 x 2"	20
Clutch Flywheel Bolt	60-65

AIR CONDITIONING SPECIFICATIONS

COMPRESSOR

Make	Trane
Type	COM-1084
Model	G7H-30X2
No of Cylinders	3
Displacement	18.45 cu. in. per rev.
Recommended Maximum Head Pressure	425 PSI (Gauge)
Initial Oil Charge	5 Pts.
Minimum Oil Pressure (Hot Oil at Engine Idle)	30 PSI (Gauge)

DEHYDRATOR STRAINER

Make	Alco Valve Co.
Type	Disposable

EXPANSION VALVE—UNDERFLOOR EVAPORATOR

Make	Alco Valve Co.
Superheat Adjustment	External
Superheat Setting	15°-19°F.

EXPANSION VALVE—FRONT EVAPORATOR

Make	Alco Valve Co.
Superheat Adjustment	External
Superheat Setting	10°-14°F.

HI-LO PRESSURE CUT-OUT SWITCH

Make	Penn Electric Switch Co.
Type	1277MP12-1
Model	1502
High Pressure Switch	
Opens at	425 + 0 ° PSI (Gauge) − 10° PSI (Gauge)
Closes at	375 PSI (Gauge)
Low Pressure Switch	
Opens at	10 ± 5° PSI (Gauge)
Closes at	30 ± 5° PSI (Gauge)

ACCESSORY DRIVE GEAR RATIO

Engine to Compressor	1.58 to 1

CONDENSER FAN DRIVE MOTOR

Make	Prestolite
Model	MJY-4001
Low Speed	
Volts	25.5-27.5
Amps (Armature)	40-50
Amps (Field)	6.0-8.0
Fan R.P.M.	1775-1850
High Speed	
Volts	25.5-27.5
Amps (Armature)	78-88
Amps (Field)	2.5-4.5
Fan R.P.M.	2350-2425

CONDENSER FAN PRESSURE SWITCH

Make	Ranco
Model	010-1025
Cut-Out Pressure	295 ± 5° PSI
Cut-In Pressure	325 ± 5° PSI

AIR CONDITIONING SPECIFICATIONS (CONT.)

CLUTCH CONTROL AIR CYLINDER

Make	Midland Ross
Model	N-3869
Stroke	1.120"

COMPRESSOR DRIVE CLUTCH

Clutch Size	9⅛" Dia.
Type	Single Plate, Dry Disc
Release Bearing Type	Sealed Ball
Spring	Belleville

HEAT AND AIR COND. RELAY
AND AIR COND. CLUTCH RELAY

Make	Delco-Remy
Model No.	1116964
Air Gap at Core	
Points Closed (In.)	0.011 Min.
Point Opening (In.)	0.030
Closing Voltage (Range)	15.5-18.5
Opening Voltage	1.5 Min.
Sealing Voltage	22.5 Max.

CONDENSER FAN HI-SPEED RELAY

Make	Delco-Remy
Model	1115860
Point Opening (In.)	0.020-0.030
Sealing Voltage	14-18

AIR COND. CLUTCH SOLENOID VALVE

G.M. Part No.	643382
Make	Skinner Chuck Co.
Model	V5J-22355
Type	Normally Closed
Voltage	24

AIR COND.—ENGINE OIL
PRESSURE SWITCH

Make and Number	AC-5653937
Type	Normally Closed
Contact Break Pressure	23-27 PSI

AIR COND.—CLUTCH CONTROL
AIR PRESSURE SWITCH

Make and Number	AC-1508844
Type	Normally Open
Contact Closing Pressure	65 ± 3 PSI

Air Conditioning

(MODEL PD-4108)

Air conditioning system information pertaining to the PD-4108 coach model is the same as previously covered under AIR CONDITIONING - MODEL PD4905 in this supplement except as follows.

This group, covering operation, maintenance, and repair information on the model PD-4108 coach air conditioning system, is divided into major sections as shown below:

Subject	Page No.
General Description	199
System Operation	200
System Maintenance	202
System Services and Tests	221
Troubleshooting	227
Lubrication and Inspection	232
Equipment and Materials	234
Specifications	235

NOTE: Air conditioning controls and units, such as the temperature control Grad-U-Stat, underfloor blowers, heater core unit, air filter screen, and water pump, are also used in conjunction with the coach heating system. These controls and units which are common to both systems are covered in "HEATING AND VENTILATION" section of this group 26.

GENERAL DESCRIPTION

The coach air conditioning system is designed to provide passenger comfort by cooling, dehumidifying, and filtering the air which is force circulated within the coach. The entire heating system is utilized to control or temper the air which is cooled by the air conditioning system. This tempering or temperature-raising process provides the necessary "reheat" phase of the air conditioning system.

The air conditioning system units are accessible through access doors at left and right side of coach, through access openings in forward baggage compartment bulkhead, and through engine compartment door. System units are shown schematically in figure 1. Refer to figure 3 for a schematic wiring diagram of the air conditioning system. The air conditioning system is comprised of the following units and controls.

THE CONDENSING SYSTEM

The condensing system consists of:

1. A six-cylinder axial-type refrigerant compressor, belt driven from the engine crankshaft pulley. The compressor is bracket mounted to engine at left side of coach as shown in figure 2.
2. A fin and tube-type condenser coil with a six-blade cooling fan. Fan blade is rotated by an electric motor.
3. A liquid refrigerant receiver mounted within the condenser compartment.

THE COOLING UNITS

The PD-4108 and PD-4905 coach models utilize the same cooling units except the PD-4108 coach does not have an evaporator coil mounted above the front heater and only one expansion valve is used.

NOTE: Refer to "Cooling Units" under "General Description" in AIR CONDITIONING - MODEL PD-4905 previously for a description of the cooling units.

AIR CIRCULATION SYSTEM

The air circulation system consists of the same air intakes, filters, blowers and air distribution ducts used in the coach heating system.

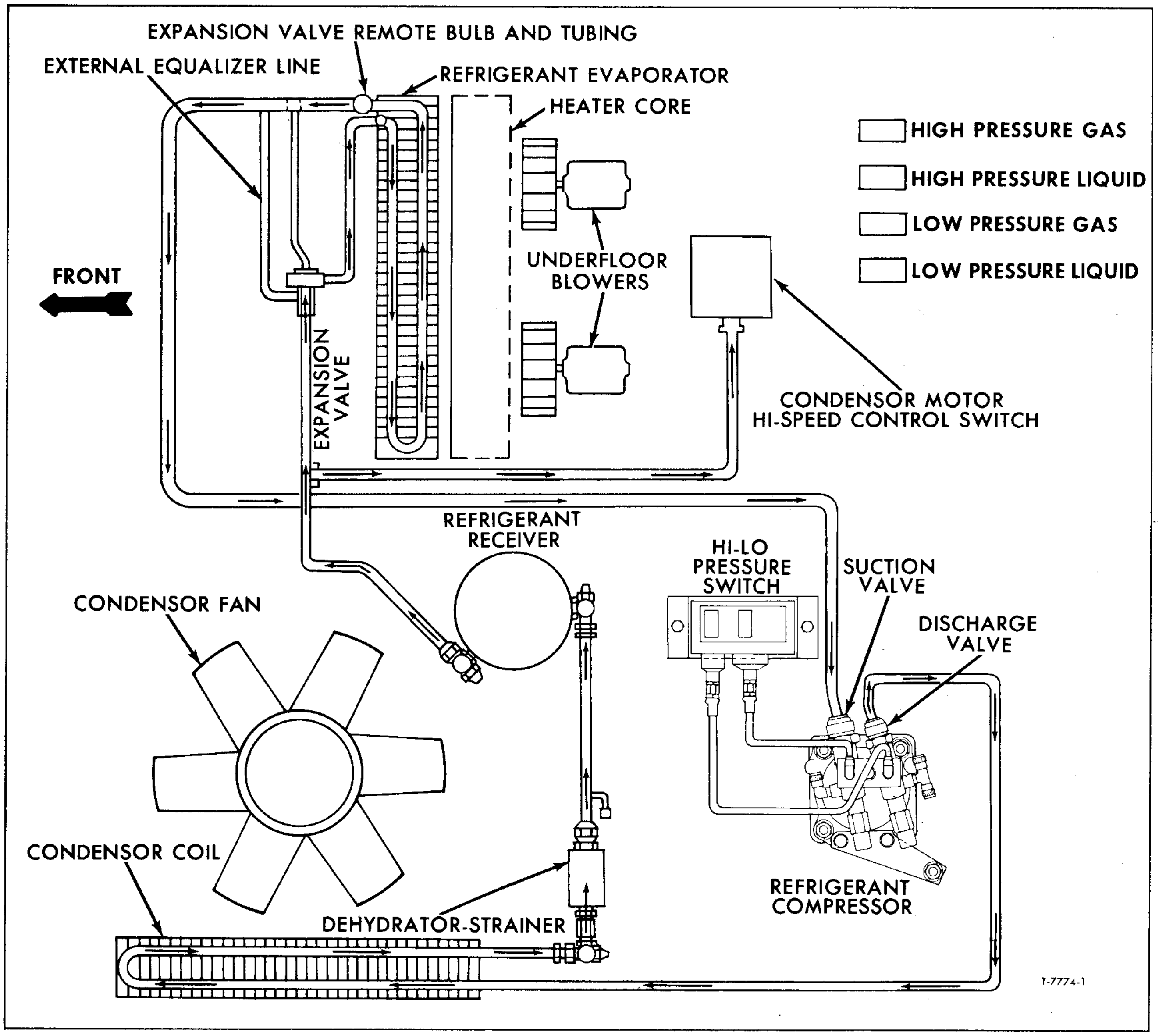


Figure 1—Schematic of Refrigerant Controls and Lines Showing High and Low Pressure

SYSTEM CONTROL UNITS

The air conditioning system controls consist of a "HEAT-AIR COND." switch on control panel at left of driver, a tell-tale light on tell-tale panel in front of driver, several automatic controls such as pressure switches, relays, and an air supply solenoid valve, and an electrically energized compression clutch. These controls are described later under "System Operation and Maintenance."

System Operation

Information applicable to "SYSTEM OPERATION" remains the same as covered under "SYSTEM OPERATION" in AIR CONDITIONING - MODEL PD-4905 except as follows:

REFRIGERANT CIRCULATION

Refer to "Refrigerant Circulation" in AIR CONDITIONING - MODEL PD-4905 previously for a complete cycle of the refrigerating system. Refrigerant control units and piping is illustrated schematically in figure 1.

NOTE: A front evaporator and expansion valve is not used on this coach.

OPERATION OF ELECTRICAL CONTROL UNITS

Refer to "HEATING SYSTEM" section for operation of controls such as: Grad-U-Stat, "TEMP. RANGE" control knob, air pressure regulating valve, blower motors, left and right blower motor magnetic switch, water modulation valve, and heating system water pump.

"HEAT-AIR COND." CONTROL SWITCH

The control switch marked "HEAT-OFF-AIR COND." on control panel at left of driver is a three-position toggle-type switch.

With switch in "AIR COND." position, the circuit to underfloor blowers is completed causing motors to operate at high speed. Circuit is also completed to the refrigerant "HI-LO" pressure switch. Electrical circuits and connections are shown on applicable "Heating and Air Conditioning Wiring Diagram" in WIRING DIAGRAMS booklet X-7014A.

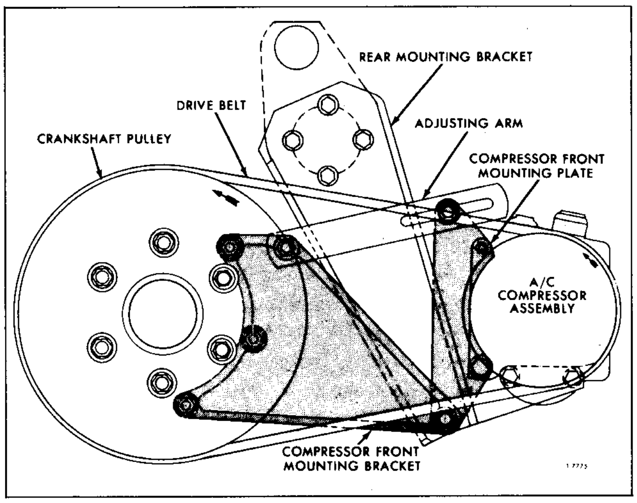


Figure 2—Air Conditioning Compressor Mounting (Typical)

RELAYS

Several relays are used to protect or control the air conditioning system. These relays are located on driver's control and apparatus panel at left of driver and on engine compartment apparatus panel. Refer to "Relays" in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) for operation of relays.

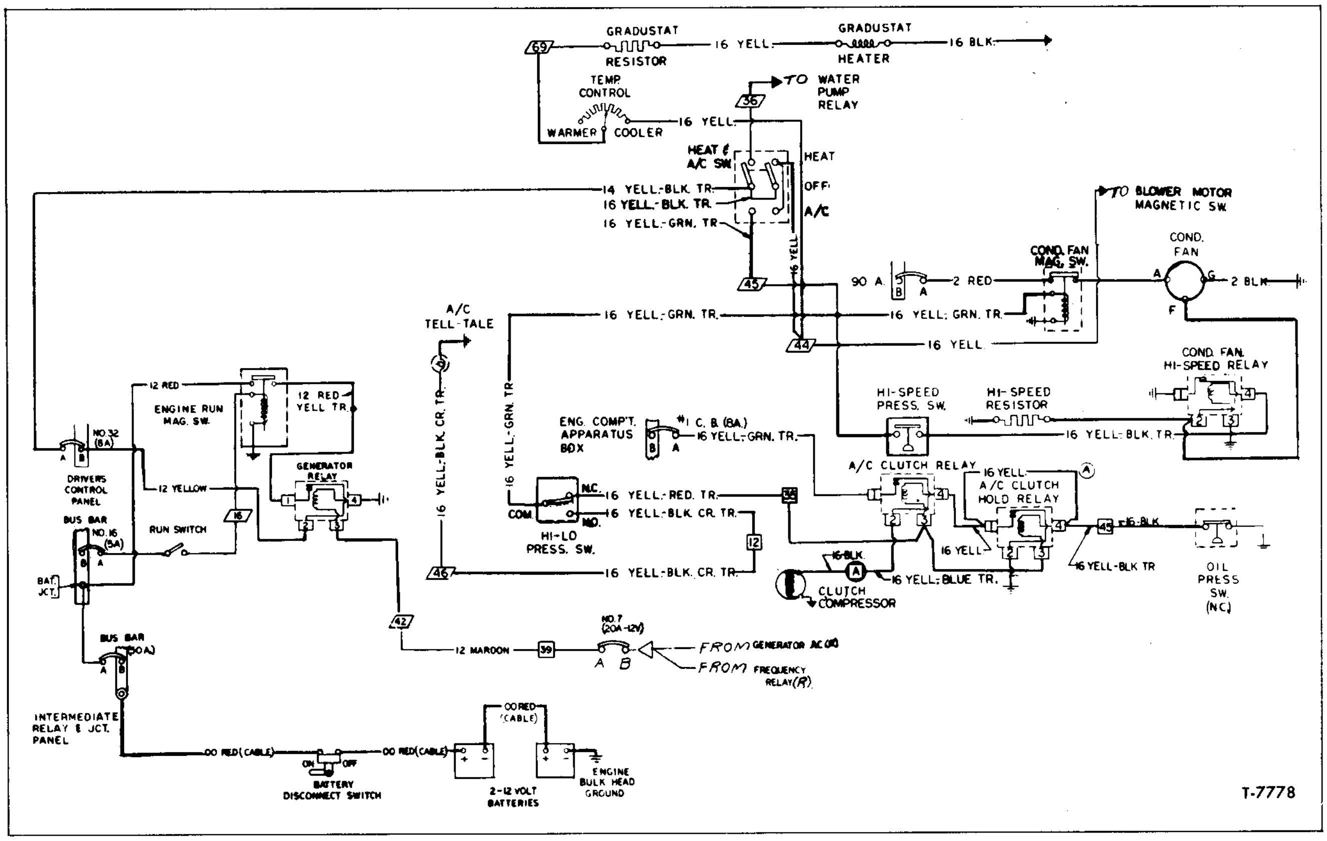


Figure 3—Schematic Diagram of Air Conditioning System (Model PD-4108)

Following is a brief description of the function of each relay:

Generator Relay

This relay, mounted on driver's control and apparatus panel at left of driver, is used to feed the "HEAT-AIR COND." switch through No. 32 circuit breaker on driver's control and apparatus panel when generator is charging. This circuit is used to shut down the heating and air conditioning system when generator is not charging.

Air Conditioning Clutch Relay

This relay, mounted on the engine compartment apparatus panel, is used to complete electrical circuit to the refrigerant compressor drive clutch. Relay is a lock-in type unit; that is, after operating coils are energized and contacts close, contacts will remain closed as long as the circuit through the contacts is not broken. The lock-in feature of this relay maintains circuit to the air conditioning compressor clutch after the engine oil pressure switch opens. Any one of the following conditions can break the circuit and cause relay contacts to open:

1. Excessively high or low refrigerant pressure.
2. Engine stops running.
3. "HEAT-AIR COND." switch not in "AIR COND." position.
4. Oil cooled generating system fails.

Air Conditioning Clutch Hold Relay

This relay, mounted on engine compartment apparatus panel, is used to energize the air conditioning clutch relay operating coil circuit after the oil pressure switch contacts open.

Relay is a lock-in type unit; that is, after operating coils are energized and contacts close, contacts will remain closed as long as the circuit through the contacts is not broken. The lock-in feature of this relay maintains a ground circuit for the air conditioning clutch relay after oil pressure switch contacts open.

ENGINE OIL PRESSURE SWITCH

Engine oil pressure switch is mounted in manifold on engine compartment apparatus panel as shown in figure 7 in "WIRING AND MISCELLANEOUS ELECTRICAL" in ELECTRICAL SYSTEM (SEC. 7) of this supplement.

With engine running and oil pressure at 25 psi or more, switch contacts are open. Purpose of this switch is to prevent engagement of air conditioning compressor drive clutch if switch is placed in "AIR COND." position with warm engine running above 800 rpm.

REFRIGERANT "HI-LO"
PRESSURE SWITCH

Definite high and low refrigerant pressures are established at which the system will operate efficiently and safely. "HI-LO" pressure switch is provided to prevent operation of system when pressures exceed these limits. The switch is mounted on engine compartment bulkhead.

The "HI-LO" pressure switch is connected to high and low refrigerant pressures at the compressor. Current from the "HEAT-AIR COND." switch is routed through the "HI-LO" pressure switch. Whenever refrigerant pressure exceeds high or low limits, listed in "Specifications" at end of this section, the switch contacts will open to complete circuit to the "A/C STOP" tell-tale lamp on tell-tale panel in front of driver and break circuit to the compressor clutch to stop the compressor. Tell-tale, when illuminated, indicates that compressor is not operating. When refrigerant pressures normalize to the switch cut-in point, compressor clutch control circuit is completed and compressor becomes operative.

System Maintenance

Information applicable to system maintenance remains the same as covered under "SYSTEM MAINTENANCE" in AIR CONDITIONING - MODEL PD-4905" previously, except as follows:

REFRIGERANT HI-LO PRESSURE SWITCH

The refrigerant "HI-LO" pressure switch (fig. 4) is a dual pressure control switch connected in series with the air conditioning control circuit, and actuated by high and low refrigerant pressure.

The control unit consists basically of two bellows connected through spring-loaded toggle linkage to a set of contact points, all enclosed within a dustproof case.

Low pressure cut-out and cut-in points are adjustable; high pressure cut-out is adjustable but the high pressure differential is fixed and non-adjustable. Adjustment screws are provided on top of case to permit making adjustments with a straight screwdriver.

When connecting lines to either bellows, use a wrench on hex portion of bellows element while tightening hose fittings to prevent damaging bellows.

The "HI-LO" pressure cut-out switch is properly set at the factory and should not normally require adjustment in the field. However, in the event of improper operation, switch operation can be tested and adjusted, if necessary, as follows:

LOW PRESSURE TEST AND ADJUSTMENT

Low pressure cut-out is an extremely important adjustment. System will not function satisfactorily and possible damage to compressor may result if switch points fail to open near the designated pressure. In making the following test, an accurate compound (pressure and vacuum) gauge should be used. Gauge set can be obtained from local refrigeration sales and service dealer.

1. Remove cap from suction pressure line test gauge fitting at compressor, then connect pressure gauge line to valve. Close suction valve on compressor slowly by turning valve stem in (clockwise) until valve seats.

2. Start coach engine and operate compressor. Observe pressure reading on gauge at the instant compressor clutch becomes disengaged and compressor stops. Switch points should open to disengage clutch at 10 psi gauge pressure.

3. Next, allow pressure to build up until compressor clutch becomes engaged. Pressure reading on gauge when switch points close and complete circuit to compressor clutch drive should be 30 psi.

4. If switch points do not open and close at gauge readings specified in Steps 2 and 3, adjust as follows:

a. If only the cut-out point requires adjustment, turn differential range adjustment screw (2, fig. 4) to obtain correct setting.

b. If the cut-in point requires adjustment, turn the low pressure cut-in adjustment screw (3, fig. 4) which changes the cut-in and cut-out points an equal amount, then adjust the cut-out point by turning screw (2, fig. 4).

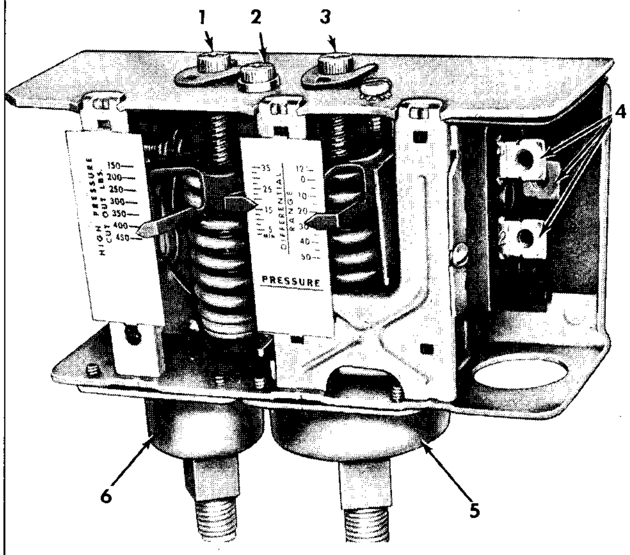
c. After completing the adjustments, recheck operation of unit, then check suction valve.

HIGH PRESSURE TEST AND ADJUSTMENT

The high pressure side of the switch should open the points and disengage compressor clutch at 425 psi gauge discharge pressure and permit points to close to engage the compressor clutch when pressure drops to 275 ± 5 psi. The point at which switch cuts out is adjustable, but the cut-in point is not adjustable. Using an accurate high pressure gauge, test and adjust switch as follows:

1. Remove cap from discharge pressure line test gauge fitting at compressor, then connect the gauge set high pressure line to valve.

2. With both the suction and discharge valves in operating position (cracked ½ to 1 turn away from backseated position), operate the compressor. Stop the condenser fan or block coil while system is operating and observe pressure reading on gauge the instant the compressor stops. If gauge reading when compressor stops is more or less than 425 psi, adjust by turning adjusting screw (1, fig. 4).



1 High Pressure Cut-Out Adjustment
2 Low Pressure Differential Range Adjustment
3 Low Pressure Cut-In Adjustment
4 Contact and Terminal Assembly
5 Low Pressure Bellows
6 High Pressure Bellows

1-7801

Figure 4—Refrigerant "Hi-Lo" Pressure Switch

CAUTION

If high pressure switch fails to disengage compressor clutch when pressure reaches 435 psi, stop compressor. Pressure in excess of this amount may damage other units.

3. When pressure cut-out switch stops the compressor at correct pressure, continue to operate coach engine and air conditioning system until pressure equalize, then observe reading on pressure gauge when circuit is completed to compressor clutch drive. If switch does not permit points to close at 275 ± 5 psi gauge pressure, the complete control unit should be replaced.

PRESSURE SWITCH REPLACEMENT

1. Pump down the system as directed later under "SYSTEM SERVICES AND TESTS."

2. Back-seat compressor suction valve to close line to low pressure fitting at switch.

3. Disconnect refrigerant pressure lines and immediately cap line fittings to seal moisture and air from system.

4. Reverse the above procedures to install pressure switch.

5. After installing switch assembly, place system back in operating position, then vent or crack line connections at switch. Tighten connections firmly after purging.

NOTE: If system was left open for an extended period of time, it may be necessary to evacuate that portion of the system.

REFRIGERANT COMPRESSOR

The refrigerant compressor, mounted at rear of coach, is a six-cylinder axial-type unit, belt driven from the engine crankshaft pulley (fig. 2). The compressor is of basic double-action piston design. Three horizontal double acting pistons make up a six-cylinder compressor and are mounted axially around the compressor shaft to operate in a front and rear cylinder assembly. These pistons are actuated by a wobble plate pressed on the compressor mainshaft.

Suction and discharge valves are mounted in valve plates between the cylinder assembly and the rear head at each end of the compressor. The heads are connected by gas-tight passageways which direct refrigerant gas to a common output.

The compressor mainshaft is driven by the pulley when the clutch coil is energized. It extends through the compressor front head to the compressor rear head and drives the oil pump in the rear head pump cavities.

The pulley assembly contains an electrically controlled magnetic clutch which permits the compressor to operate only when air conditioning is desired. The clutch actuating coil is molded into the coil housing with an epoxy resin; therefore, the coil and housing must be replaced as a complete assembly.

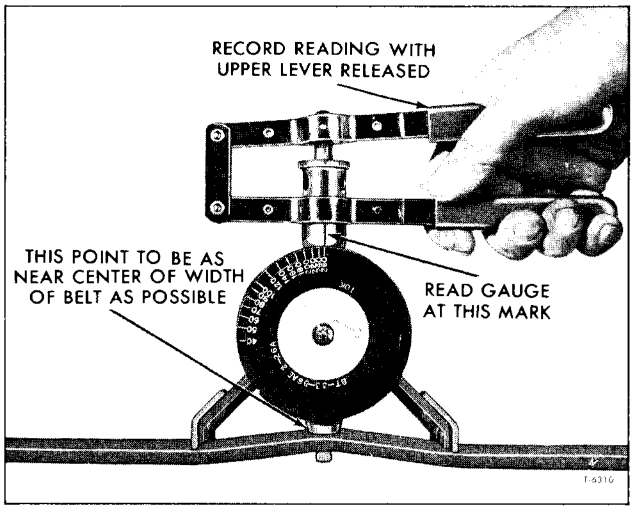

RECORD READING WITH UPPER LEVER RELEASED
THIS POINT TO BE AS NEAR CENTER OF WIDTH OF BELT AS POSSIBLE
READ GAUGE AT THIS MARK
T-6310

Figure 5—Using Poly-V Belt Tension Gauge (Typical)

COMPRESSOR MAINTENANCE

Compressor requires practically no maintenance other than making sure that sufficient (but not too much) oil and refrigerant is maintained in the system at all times. The lubrication system of the compressor will fail if the system loses its charge of oil or refrigerant. Both oil and refrigerant must be circulated through the compressor whenever it is running to prevent very serious damage. Check compressor mounting bolts and alignment periodically. Check for indication of oil or refrigerant leakage. Leakage should be remedied promptly to prevent excessive refrigerant and oil loss. Check and adjust compressor belt tension as explained under "Compressor Drive Belt Tension Adjustment." If necessary, compressor can be overhauled as explained later.

COMPRESSOR DRIVE BELT TENSION ADJUSTMENT

Compressor belt tension should be adjusted using belt tension gauge (J-23586) as shown in figure 5. Gauge should be placed at center of longest belt span to obtain proper reading. When adjusting a new drive belt, adjust belt tension to 110-120 pounds, turn engine over several times, then reset belt tension to 110 to 120 pounds.

NOTE: A Poly-V belt is considered used after 1-hour's operation, or approximately 50 miles of operation. Used belts should be adjusted to 90 to 100 pounds using a belt tension gauge.

DRIVE BELT REPLACEMENT

1. Loosen bolt at compressor adjusting arm and loosen pivot bolt at compressor support bracket, if necessary.
2. Move compressor toward engine until belt can be removed from pulley.
3. To install new belt, position belt on pulley and move compressor away from engine until a tension of 110 to 120 pounds is obtained on a belt tension gauge.
4. Tighten compressor adjusting arm bolt and pivot bolt.

COMPRESSOR SHUT-OFF VALVES

Double seating shut-off valves (fig. 6) are provided at the compressor discharge and suction ports. With both valve stems turned all the way in (clockwise-closed), compressor is isolated from the rest of the system. "OPERATING POSITION" of valves, frequently referred to in this section, is with the valve stem turned in two turns from full back-seated position as shown in figure 6.

NOTE: On these coaches, it is necessary to place valves in the "OFF" (back-seated) position to facilitate use of the "Schrader" type valves for tests.

COMPRESSOR REPLACEMENT

NOTE: A closure plate should be fabricated to dimensions shown in figure 7 to close off the compressor.

If the system has been or can be operated for more than two minutes, circulation of oil from the compressor to other components of the system will require adjustment of the oil charge in the new compressor as explained under "Adding Oil To Compressor" in "SYSTEM SERVICES AND TESTS."

After draining and measuring the oil from the crankcase, the amount that has migrated to other parts of the system can be determined by subtracting the amount drained from the original oil charge of 11 fluid ounces. The amount of oil equal to this loss shall be drained from the new compressor assembly before it is installed.

COMPRESSOR SEAL

The existence of slight amounts of oil in the immediate area surrounding the compressor is NOT necessarily an indication of a leaking seal. It must be remembered that all moving parts need lubrication. For this reason, the compressor is so designed to allow a slight flow of oil into the areas of the compressor beyond the seals. Since the compressor components are rotated at high speeds, some of this oil may be thrown off the rotating parts. Consequently, do not replace compressor seal until the system is properly checked for leaks. If no leak is found in the seal area, do not replace the seal.

A tool (J-22974) is available to aid in replacing the compressor shaft seal. This tool slides on the shaft and mates flush with shaft step to provide an even surface for seal to slide past during installation.

REPLACING AN OPERABLE COMPRESSOR

After idling compressor (on vehicle) to be replaced for 10 minutes at approximately 1500 engine rpm, at maximum refrigeration and blower at high speed: (DO NOT add any more oil to the compressor than is necessary or maximum cooling will be reduced.)

1. Compressor replaced with service compressor assembly.

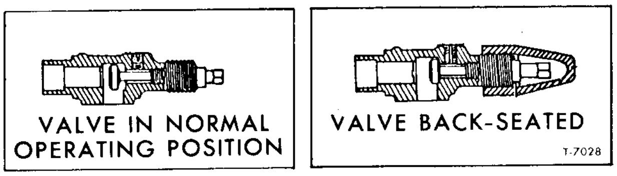


Figure 6—Refrigerant Service Valves (Typical)

a. Remove compressor and place in a horizontal position with drain plug downward, drain compressor, measure quantity of oil drained and then discard it.

b. Drain oil from replacement compressor and save it.

c. (1) If amount of oil drained in "a." previously is more than 4 ozs., place into the new compressor the same amount of oil drained from the replaced compressor.
   (2) If amount of oil drained in "a." previously is less than 4 ozs., place 6 ozs. of oil in the replacement compressor.

d. Install compressor.

2. Compressor replaced with a field repaired (overhauled) compressor.

Proceed as in Step 1 previously, and then add one extra ounce of oil. (More oil is retained in a drained compressor than one that has been rebuilt.)

REPLACING AN INOPERATIVE COMPRESSOR

In the case when it is not possible to idle the compressor to be replaced to effect oil return to it, the following will apply. DO NOT add any more oil than is necessary as maximum cooling will be reduced.

1. Remove compressor from vehicle, drain and measure the oil.

2. If amount drained in Step 1 previously is more than 1½ fluid ozs., subtract this amount drained from the original oil charge of 11 ozs., to

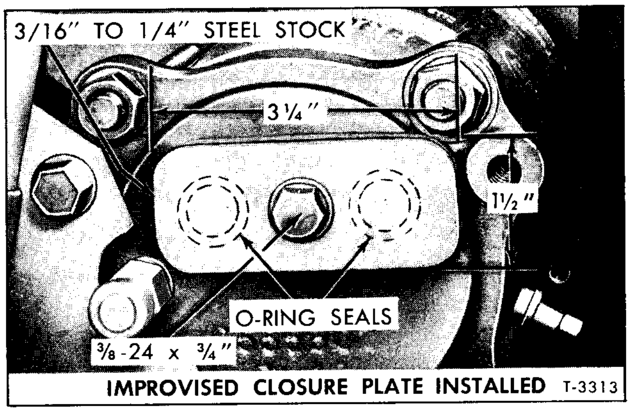


Figure 7—Improvised Closure Plate Installed

obtain "oil loss." Take the new compressor assembly and drain from it the amount of "oil loss" above; provided the refrigeration system shows no evidence of a major leak, indicating that little or no oil has been lost from the system. (Minor leak indicating very slow leakage.)

3. If oil drained in Step 1 previously contains any foreign material such as chips, or there is evidence of moisture in the system, replace the dehydrator-strainer assembly and flush all component parts, or replace if necessary. After flushing refrigeration system in this manner, the full oil charge should be left in the new service compressor or 11 ozs., installed in an overhauled or repaired compressor.

COMPRESSOR REMOVAL

1. Connect the high and low pressure gauge lines from the gauge set to the respective connections on the old compressor on the vehicle. Be sure valves on gauge set are fully clockwise to close gauge set to center fitting, and that a Schrader adapter (J-5420 or J-9459) is between low pressure hose and suction gauge fitting, and also at the discharge gauge fitting.

2. Remove the flare nut from center connection on gauge manifold or the plug in the gauge line attached to the center connection. Wrap the line at the outlet with a cloth to protect persons and vehicle surfaces from oil or refrigerant.

3. Slowly depressurize refrigeration system as instructed under "Depressurizing The System" in "SYSTEM SERVICES AND TESTS" later in this section.

4. While system is depressurizing, remove (if desired) clutch assembly and coil from old compressor. If parts are not oil soaked and are in good condition, lay them aside on a clean surface as they may be installed on the new compressor.

5. After the system is completely depressurized, very slowly loosen screw which retains compressor fittings assembly to compressor. As screw is being loosened, work fittings assembly back and forth to break seal and carefully bleed off any remaining pressure.

CAUTION: High pressure may still exist at the discharge fitting. If this pressure is released too rapidly there will be a considerable discharge of refrigerant and oil.

6. When all pressure has been relieved, remove fittings assembly and O-ring seals.

7. Immediately cover compressor openings. A simple way is with a plate (similar to the one on new compressor) which can be attached with fittings assembly screw, using the O-rings to provide a seal.

8. Disconnect compressor clutch coil wire and remove compressor mounting plates to bracket bolts, front and rear.

9. Loosen brace and pivot bolts and detach drive belt.

10. Remove nuts and bolts attaching compressor to mounting brackets. Remove compressor.

11. Drain all oil from compressor just removed in a clean dry container and replace compressor drain plug screw. Measure amount of oil drained. See "Checking Compressor Oil Level and Adding Oil" in "SYSTEM SERVICES AND TESTS" later.

COMPRESSOR INSTALLATION

NOTE: Before installing a new compressor, rotate compressor shaft four or five times. This permits proper lubrication of compressor seal over all its surface. Before compressor clutch is mounted to the new compressor, wipe the front face of the compressor thoroughly with a clean dry cloth and, if necessary, clean front of compressor with a solvent to remove any excess oil. Cleaning compressor in this manner will prevent any oil from being thrown onto the clutch surfaces which would cause slippage and eventual clutch failure.

1. Stamp refrigerant charge of the refrigerant system on new compressor in space on plate provided for this information.

NOTE: Follow procedure for replacing oil in new compressor explained previously under "Removing Malfunctioning Compressor and Installing New Compressor."

2. Install compressor to engine leaving compressor fittings opening cover plate on the compressor.

3. Remove cover plate from compressor openings very slowly to bleed off pressure.

CAUTION: New compressors are charged with a mixture of nitrogen and Refrigerant-22 and 11 fluid ozs. of Frigidaire-525 viscosity oil. If the cover is removed too rapidly, the oil will be blown out violently with the sudden release of pressure.

4. Install the connector assembly to the compressor rear head, using new O-rings.

5. Connect the electrical lead to the coil, then install and adjust compressor drive belt as explained under "Compressor Drive Belt Tension Adjustment" previously.

6. Install coil and clutch parts if not already installed.

7. Evacuate, charge, and test system as explained under "SYSTEM SERVICES AND TESTS" later in this section.

8. Leak test the system and check for proper operation.

REFRIGERANT COMPRESSOR OVERHAUL

Before overhauling compressor (fig. 10), the system must be pumped down and the unit removed from the coach. Instructions for pumping down the system are explained later under "SYSTEM SERVICES AND TESTS." Procedures for removing the compressor are explained previously under "Compressor Replacement."

> **IMPORTANT**
>
> **The immediate area in which the compressor is to be overhauled should be dust-free, and if pieces of cloth are to be used for the cleaning of parts, they should be lint free.**

When servicing parts of the compressor, handle parts carefully and protect them against rusting immediately upon removal from compressor housing. Before installing parts, wash with refrigeration compressor parts cleaner, then oil with new (clean) compressor oil. This applies especially to seal and bearing surfaces to prevent seizure when unit is first put in operation. Use new O-ring seals and gaskets at build-up of compressor.

GENERAL

In addition to normal shop equipment, various special tools will be needed to facilitate overhaul of the air conditioning compressor covered in this supplement. References are made to the use of these tools throughout the supplement. A complete list is given under "Special Tools" found at the end of this supplement.

The following overhaul test is a series of procedures for removal, inspection, and installation of the various individual components of the compressor. For complete disassembly, follow the component "Removal and Inspection" portions of each procedure in the order given. For complete assembly after overhaul follow the "Installation" portion of each procedure working from the last component covered, back to the first.

TROUBLESHOOTING AND DIAGNOSIS

COMPRESSOR INOPERATIVE

If the compressor is inoperative, the electrical lead to the clutch should be checked first. If there is current to the clutch and the compressor is not seized, the clutch is defective.

Failure of the compressor to operate may be caused by a defective clutch coil, control switch, fuse, or wiring. If the clutch is in good operating condition and if there is no break in the electrical continuity of the system, compressor failure may be due to seizure. Operation of a seized or partially seized compressor will cause the clutch or belt to slip and may damage the clutch. Attempt to rotate the compressor shaft by using a ratchet drive wrench on the compressor shaft nut. If the shaft will not turn, the compressor is seized.

HIGH COMPRESSOR DISCHARGE PRESSURE

If the compressor discharge pressure ever becomes too high, a pressure-relief valve opens automatically. This valve opens only in emergency situations to release excessive pressure. Opening of the relief valve may be accompanied by a loud popping noise and perhaps the ejection of some oil with the refrigerant. Any condition which causes this valve to open should be corrected immediately.

LOW COMPRESSOR DISCHARGE PRESSURE

Low discharge pressures during full load conditions may be caused by insufficient refrigerant or a restriction on the suction side of the system as well as by a faulty compressor. In diagnosing for low discharge pressure, check for insufficient refrigerant and possible restrictions on the suction side of the system prior to inspecting the compressor.

COMPRESSOR NOISE

At moderate highway speeds a moan or whine may occur. It may sound something like rear axle noise and may be influenced by changing the engine speed. If the noise stops abruptly when the "HEAT-AIR COND." switch is placed in "OFF" position, the following checks may help to isolate the noise:

1. Check the compressor mounts for proper installation (not distorted or in contact with sheet metal).
2. Check the tension of all belts, favoring the high limit on the compressor belt.
3. Make sure that the suction hose is not twisted or in contact with metal parts.
4. Clamp suction liquid lines securely or insulate them with rubber padding.

5. If the pulley is quiet when the compressor is operating but noisy when the compressor is not operating, the pulley bearing assembly is defective and should be replaced.

A slight thumping or clucking noise at idle when the compressor is quite hot may change to a growl or rumble at speeds of 20 to 35 mph. This noise could easily be mistaken for engine vibration except that it stops abruptly when the "HEAT-AIR COND." switch is placed in "OFF" position.

If noise is objectionable, first check the sight glass for any indication of low refrigerant and add refrigerant, as required, after making sure that no leaks exist. If it is necessary to check further, securely tighten all compressor mounting brackets and support braces.

MINOR OVERHAUL PROCEDURES

The following operations to the hub and drive plate, pulley and bearing, and coil housing are covered as "Minor" because they may be performed without first purging the system or removing the compressor from the vehicle. The shaft seal assembly may also be serviced without removing the compressor from the vehicle, but this operation is covered later in this supplement as a "Major Overhaul Procedure" because the system must first be purged of refrigerant.

Illustrations used in describing these operations show the compressor removed from the vehicle to more clearly illustrate the various operations.

HUB AND DRIVE PLATE

REMOVAL

1. If disassembly is being performed on a bench, mount support bracket (J-9336) in a vise and attach the compressor to the bracket.
2. Using drive plate holding tool (J-9403) and socket (J-9399), remove the lock nut from the shaft (fig. 8). Discard lock nut.
3. Tool (J-9401) may now be used to remove the hub and drive plate assembly (refer to fig. 9).

NOTE: Carefully snug tool into place with wrench to ensure engagement with threads.

4. Use snap ring pliers (J-5403), remove the retainer ring (Item 37, fig. 10), then remove the hub spacer.

INSPECTION

If the frictional surface shows signs of damage due to excessive heat, the hub and drive plate and the pulley should be replaced. Check further for the underlying cause of the damage; i.e., low coil voltage or binding of the compressor internal mechanism.

INSTALLATION

NOTE: When hub and drive plate assembly is ready for installation, clean its frictional face with a suitable cleaner.

1. Insert the square hub and drive plate key into the keyway in the drive shaft allowing it to project approximately 3/16" out of the end of the keyway (fig. 11).
2. Line up the key in the shaft with the keyway in the hub.
3. Using tool (J-9480-01) (fig. 12), install the hub and drive plate assembly. Pull the assembly onto the shaft until there is approximately 3/32" space between the frictional surfaces of the drive

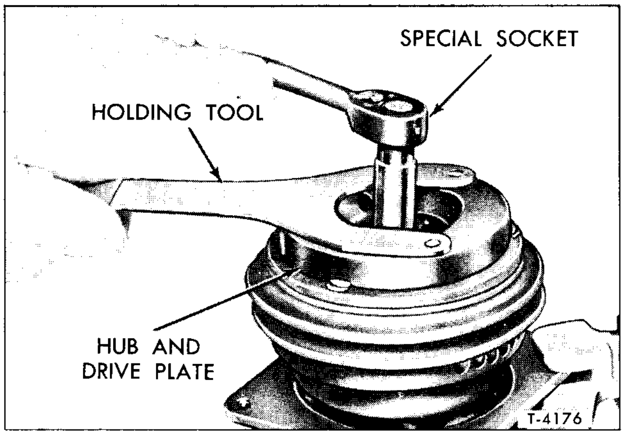


Figure 8—Removing Shaft Lock Nut

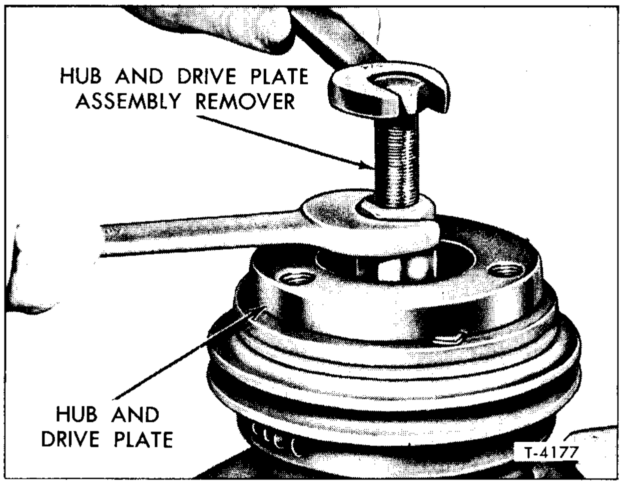


Figure 9—Removing Hub and Drive Plate Assembly

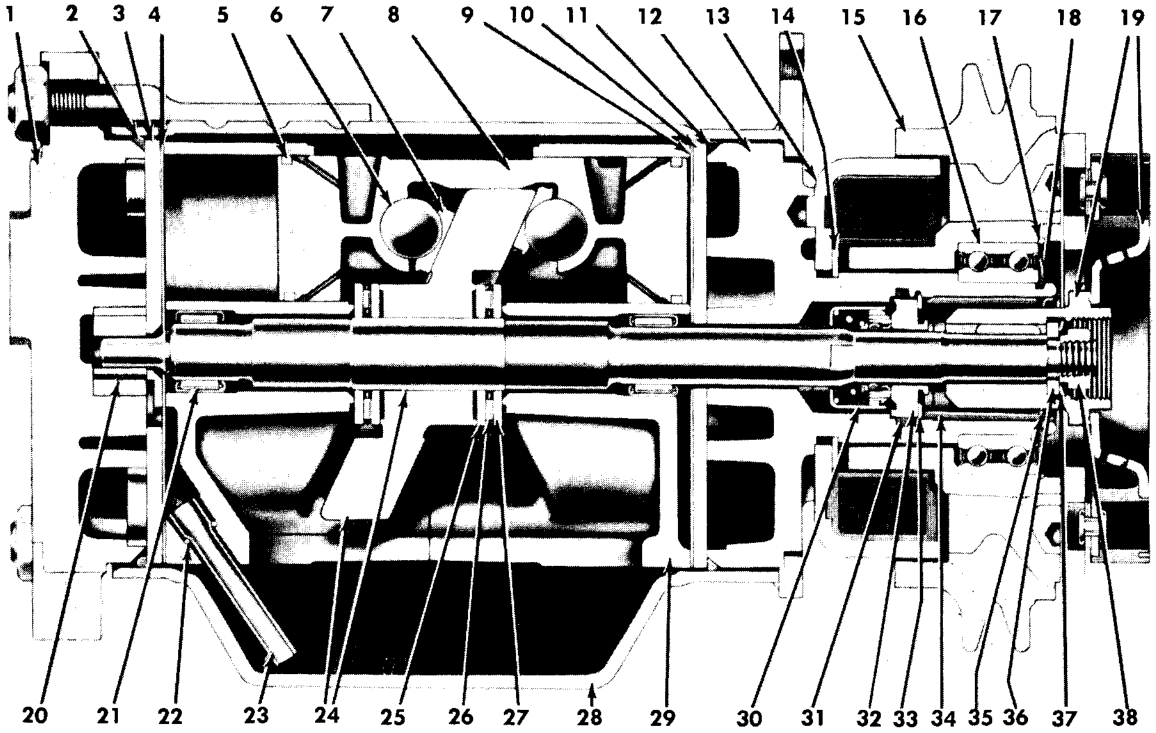
plate and pulley. (A ZERO thrust race is approximately 3/32" thickness and may be used to roughly gauge this operation.)

NOTE: Use tool (J-9403) to hold hub and drive plate if necessary.

4. Install the hub spacer washer, then using snap ring pliers (J-5403), install retainer ring (Item 37, fig. 10), convex side of ring must face washer.

5. Use tools (J-9399 and J-9403) to install new lock nut. Tighten the nut to 14-26 foot-pounds torque. Air gap between the frictional faces should now be 0.022" to 0.057".

NOTE: The shoulder or circular projection on



1 Rear Head
2 Rear Head to Shell O-ring
3 Rear Discharge Valve Plate
4 Rear Suction Reed Plate
5 Piston Ring
6 Piston Drive Ball
7 Ball Seat
8 Piston
9 Front Suction Reed Plate
10 Front Discharge Valve Plate
11 Front Head to Shell O-ring
12 Front Head
13 Coil and Housing Assembly
14 Coil Housing Retainer Ring
15 Pulley and Bearing Assembly
16 Pulley Bearing
17 Pulley Bearing Retainer Ring
18 Pulley and Bearing Retainer Ring
19 Clutch Hub and Drive Plate Assembly
20 Oil Pump Gears
21 Mainshaft Bearing (Rear)
22 Oil Inlet Tube O-ring
23 Oil Inlet Tube
24 Wobble Plate and Mainshaft Assembly
25 Thrust Race
26 Thrust Bearing
27 Thrust Race
28 Compressor Shell
29 Cylinder Assembly
30 Shaft Seal
31 Shaft Seat Seat O-ring
32 Shaft Seal Seat
33 Shaft Seal Seat Retainer Ring
34 Felt Sleeve
35 Felt Sleeve Retainer
36 Spacer
37 Clutch Hub Retainer Ring
38 Shaft Nut

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Figure 10—Refrigerant Compressor Cross Section View

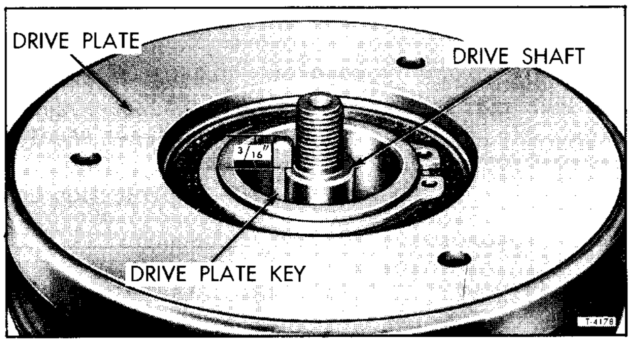


Figure 11—Drive Plate Key Installed in Key Way

the lock nut must face toward retainer ring.

6. The pulley should now rotate freely.

> **CAUTION**
>
> **Never pound or drive the hub and drive plate into position. Always use the proper tools when removing or replacing clutch parts. Failure to do so may result in serious internal compressor damage.**

7. Operate the refrigeration system and rapidly cycle the clutch (by turning the air conditioning off and on at least 20 times at approximately one second intervals) to seat the mating parts of the clutch.

PULLEY AND BEARING ASSEMBLY

REMOVAL

1. Remove the hub and drive plate assembly.

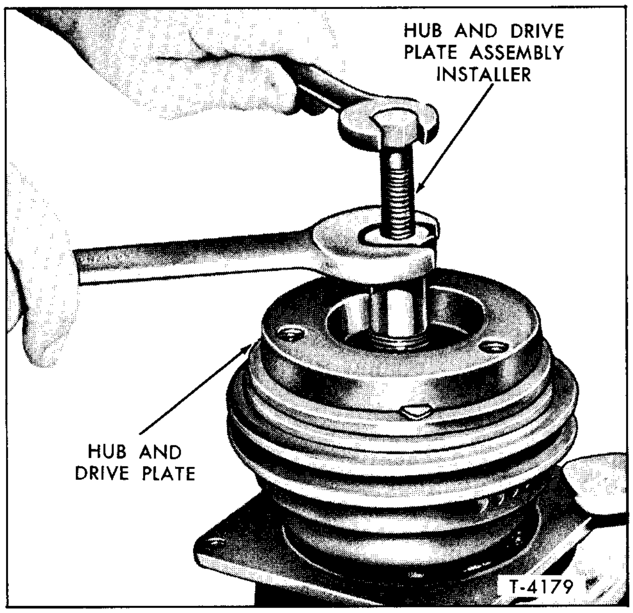


Figure 12—Installing Hub and Drive Plate Assembly

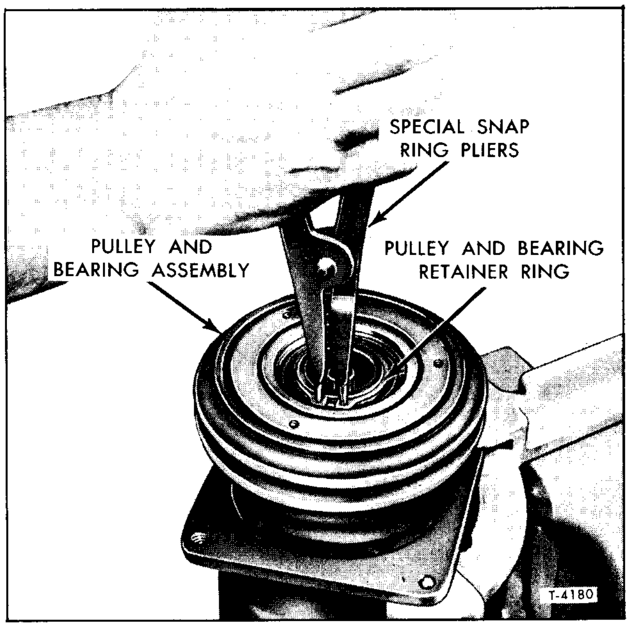


Figure 13—Removing Pulley and Bearing Assembly Retaining Ring

2. Using snap ring pliers (J-6435), remove the pulley and bearing retainer ring (fig. 13).

3. Remove shaft key.

4. Place puller pilot (J-9395) over the compressor shaft and pull off the pulley assembly using pulley puller (J-8433) (fig. 14).

INSPECTION

Check the appearance of the pulley and bearing assembly. If the frictional surface of the pulley indicates excessive grooving due to slippage, both the pulley and the clutch hub and drive plate assembly should be replaced. The frictional surfaces of the bearing to be used should be cleaned with a suitable solvent before reinstallation.

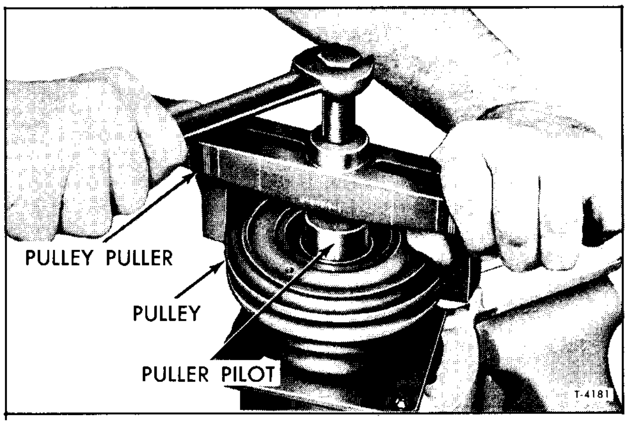


Figure 14—Removing Pulley

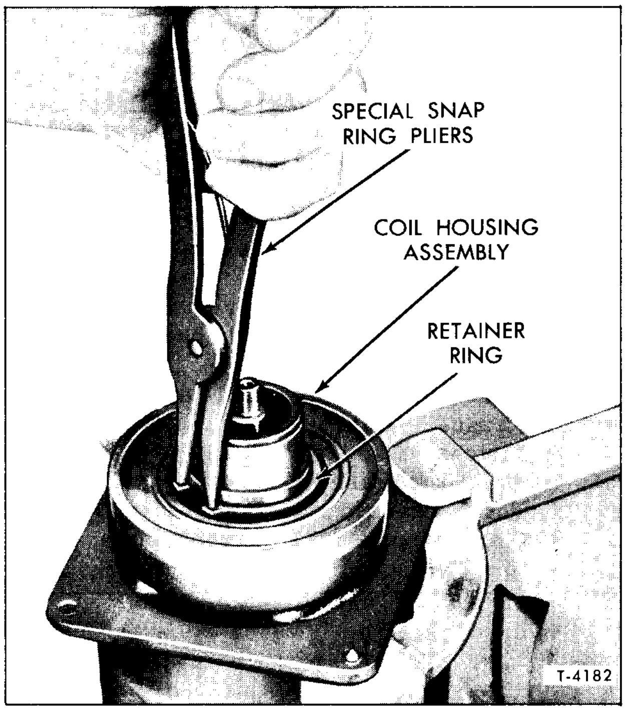


Figure 15—Removing Coil Housing Retaining Ring

BEARING REPLACEMENT

1. With the pulley and bearing assembly removed from the compressor, use a sharp pointed instrument to remove the wire retainer ring.

> ### CAUTION
> **If the bearing is to be re-used, be careful not to slip and damage the seal.**

2. From the rear of the pulley, press or drive bearing out of pulley using tool (J-9398) and handle (J-8092).
3. From the front of the pulley and using tool (J-9481) with handle (J-8092), press or drive the new bearing into the pulley. Install the wire bearing retainer ring.

INSTALLATION

1. Using tool (J-9481), press or drive the pulley and bearing assembly onto the compressor neck. The pulley should now rotate freely.
2. Install retainer ring using snap ring pliers (J-6435).
3. Replace the hub and drive plate assembly. Use proper tools. DO NOT drive or pound on the hub assembly.

COIL HOUSING ASSEMBLY

REMOVAL

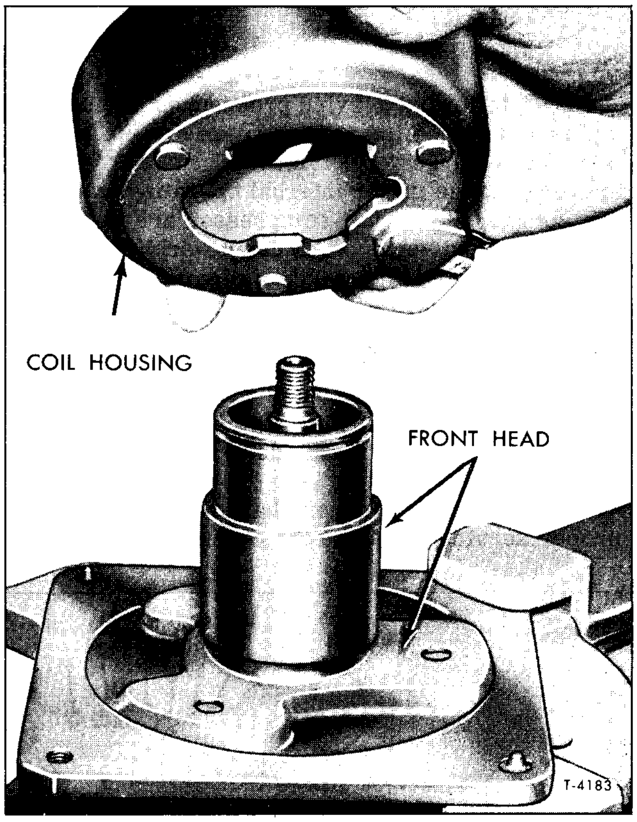


Figure 16—Coil Housing Installed

1. Remove the hub and drive plate assembly, the pulley and bearing assembly, and electrical connector.
2. Scribe location of coil housing to compressor body. This operation is to ensure that electrical terminals will be reassembled in 2 o'clock position as viewed from pulley end.
3. Using snap ring pliers (J-6435), remove coil housing retainer ring (fig. 15).
4. Remove the coil housing assembly.

INSPECTION

Check coil for loose connectors or cracked insulation. Amperage should not be more than 3.2 amps at 12 volts D.C. at room temperature.

INSTALLATION

1. Rotate the coil housing to the correct position as indicated by the scribe marks and the location of the electrical terminals and fit into place (fig. 16).
2. Use snap ring pliers (J-6435) to install retainer ring.

NOTE: Install flat surface of the retainer ring facing the coil housing.

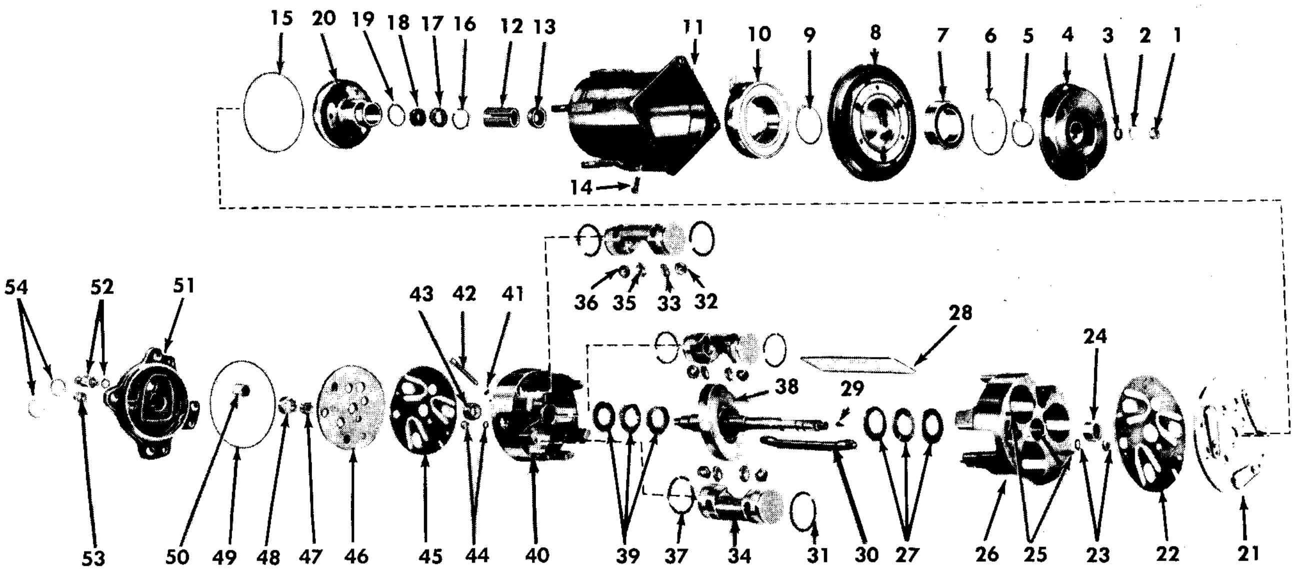
3. Replace the pulley and bearing assembly and the hub and drive plate assembly. DO NOT drive or pound on the hub assembly.
4. If the compressor is installed in the vehicle, connect the electrical connections.

MAJOR OVERHAUL PROCEDURES

The following service procedures are considered major since the refrigeration system must be completely purged of refrigerant before proceeding and/or because major internal operating and sealing components of the compressor are being disassembled and serviced. A clean workbench, preferably covered with a sheet of clean paper, orderliness in the work area and a place for all parts being removed and replaced is of great importance as is the use of the proper tools. Any attempt to use make-shift or inadequate equipment may result in damage and/or improper compressor operation. Refer to figure 17 for exploded view of compressor components.

These procedures are based on the use of the proper service tools and the condition that an adequate stock of service parts is available. This service parts stock should include the following:

1. Major interior mechanism assembly -- ready for installation in shell as is.
2. Service cylinder assembly -- front and rear halves with main bearings in place and halves dowel pinned together.
3. Standard size piston drive balls.
4. Ball seats -- total of 10 sizes, including the ZERO seat.
5. Thrust races -- total of 14 sizes, including the ZERO race.
6. Pistons.
7. Mainshaft bearings.
8. Thrust bearings.
9. Compressor shaft and wobble plate.



1 Shaft Nut
2 Clutch Hub Retainer Ring
3 Spacer
4 Hub and Drive Plate Assembly
5 Pulley & Bearing Retainer Ring
6 Pulley Bearing Retainer Ring
7 Pulley Bearing
8 Pulley
9 Coil Housing Retainer Ring
10 Coil Housing
11 Compressor Shell
12 Felt Sleeve
13 Felt Sleeve Retainer
14 Oil Drain Plug
15 Front Head-to-Shell O-ring
16 Shaft Seal Seat Retainer Ring
17 Shaft Seal Seat
18 Shaft Seal
19 Shaft Seal Seat O-ring
20 Compressor Front Head
21 Front Discharge Reed Valve
22 Front Suction Reed Valve Plate
23 Discharge Cross-over Tube Front O-ring and Spacer
24 Mainshaft Front Bearing
25 Head Locating Pins
26 Front Cylinder Half
27 Front Thrust Race and Brg.Pack
28 Suction Cross-over Cover
29 Drive Key
30 Discharge Cross-over Tube
31 Piston Ring
32 Piston Front Drive Valve
33 Piston Front Ball Seat
34 Piston
35 Piston Rear Ball Seat
36 Piston Rear Drive Ball
37 Piston Ring
38 Drive Shaft and Wobble Plate Assembly
39 Rear Thrust Race and Bearing Pack
40 Rear Cylinder Half
41 Oil Inlet Tube O-ring
42 Oil Inlet Tube
43 Mainshaft Rear Bearing
44 Discharge Cross-over Tube Rear O-ring and Spacer
45 Rear Suction Reed Plate
46 Rear Discharge Valve Plate
47 Oil Pump Drive Gear
48 Oil Pump Driven Gear
49 Rear Head-to-Shell O-ring
50 Strainer Screen
51 Compressor Rear Head
52 High Pressure Relief Valve and O-ring
53 Head-to-Shell Retaining Nuts
54 Compressor-to-Connector O-rings

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Figure 17—Exploded View of Compressor Components

10. Suction reed valves.
11. Discharge valve plate -- front and rear.
12. Seal kit -- service - contains all seals and O-rings to be used each time a compressor is rebuilt.
13. Shaft seal kit.
14. Nuts -- head to shell, and shaft.
15. Retainer rings -- all necessary sizes.
16. Cylinder locator (dowel) pins.
17. Valve and head locator (dowel) pins.
18. Service discharge cross-over tube kit.

All parts required for servicing are protected by a preservation process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the mechanism assembly just as they are removed from the service package.

Piston ball seats and shaft thrust races will be identified on the parts themselves to denote their size and dimension.

SHAFT SEAL ASSEMBLY

When replacing the shaft seal assembly, even if the compressor remains on the vehicle during the operation, it will be necessary to shut off suction and discharged valves.

REMOVAL

1. After purging system of refrigerant, remove hub and drive plate, and shaft key.
2. Before removing the seal seat and retaining ring, thoroughly clean the area of the neck of the compressor surrounding the shaft to remove all dirt or foreign material. Pry out the felt retaining ring and remove the felt sleeve. Remove the seat retaining ring using snap ring pliers (J-5403).
3. Place tool (J-22974) over end of shaft to prevent chipping ceramic seat. Engage tangs of tool (J-23128) in recess in seat turning handle clockwise.

> **CAUTION: DO NOT tighten handle with wrench or pliers. Lift seat with a rotary motion.**

4. Remove the seal seat O-ring from the housing bore using tool (J-9553) (fig. 18).
5. Engage the tabs on the seal assembly with the locking tangs on tool (J-9392) by pressing down and twisting the tool, then lift the seal out.

INSPECTION

Check the face of the seal for nicks, gouges, or serrations. If damage of any kind is evident, replace the seal. Be extremely careful that the face of the seal which is to be installed is not scratched or damaged in any way.

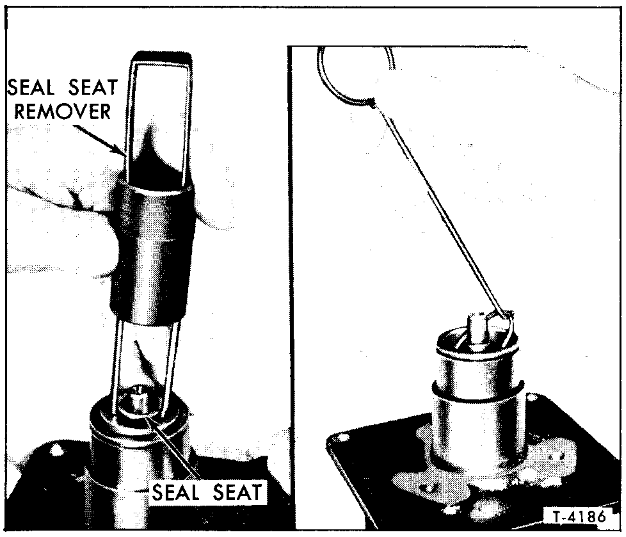

Figure 18—Removing Seal Seat and O-Ring

Apparent seal leaks are sometimes the result of mispositioning of the wobble plate on the compressor shaft caused by improper procedures during pulley removal or pounding or dropping on the compressor shaft. Check as shown in figure 19. If measurement is greater than shown, replace the shaft and wobble plate assembly.

INSTALLATION

1. Engage seal onto the locking tangs of tool

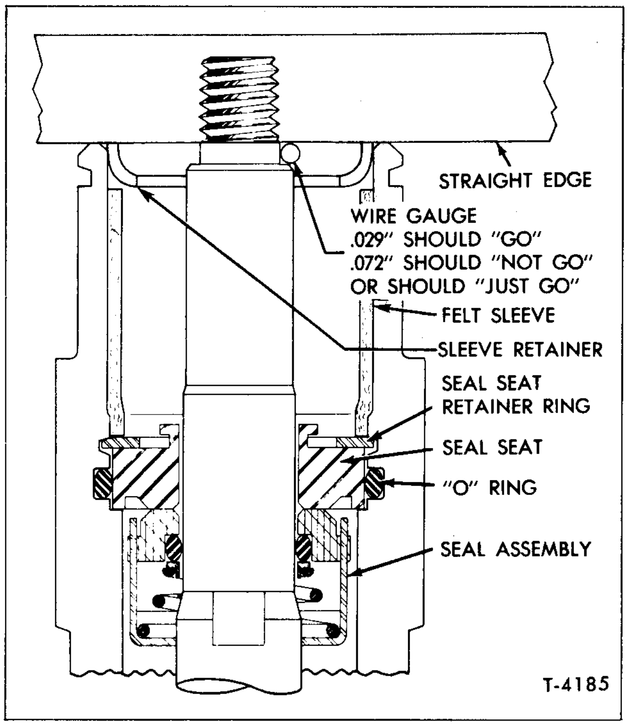

Figure 19—Checking Wobble Plate Position on Shaft

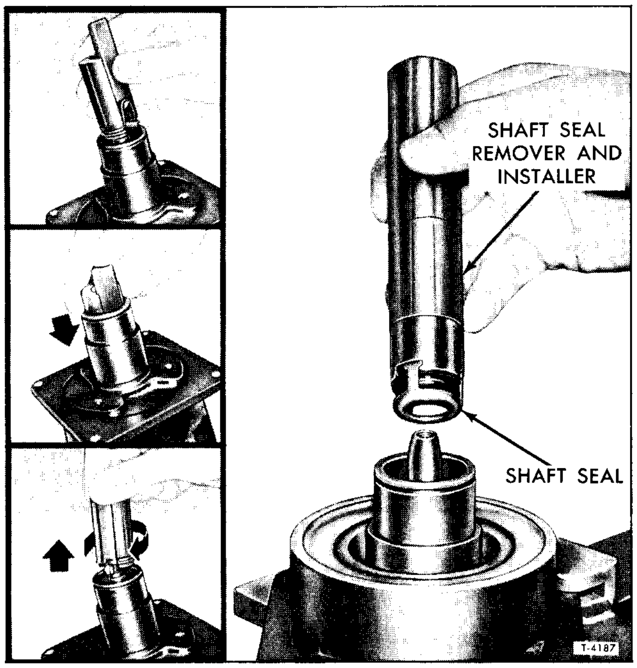

Figure 20—Installing Seal and O-Ring

(J-9392) (fig. 20) and with shaft seal protector tool (J-22974) installed over the end of the shaft, carefully insert the seal and tool over the end of the shaft. Turn seal to engage the flat on the shaft, then remove the tool.

2. Coat a new O-ring and the interior of the seal cavity, shaft and seal with clean refrigeration oil, and, using tool (J-21508), install the O-ring in its groove just above the seal.

NOTE: To install the O-ring, place O-ring on tool as shown in figure 20, insert the tool fully into the front head bore, press down the slider, twist entire tool to seat O-ring and then remove tool.

3. Using tool (J-23128), grasp the seal seat and set in place on top of the seal with a rotary motion.

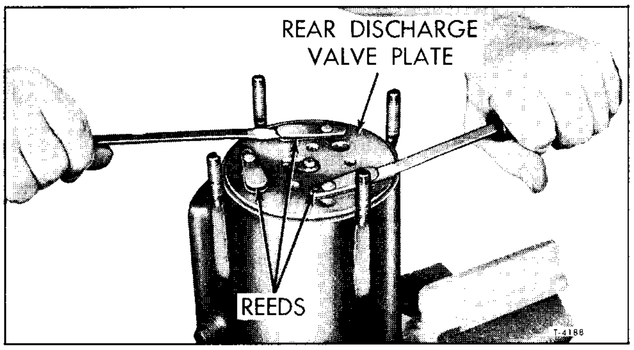

Figure 21—Removing Rear Discharge Valve Plate

4. Using snap ring pliers (J-5403), replace the retaining ring. Tap with palm of hand on barrel of tool (J-9393) to press retainer ring into place.

NOTE: Install the retaining ring with the flat surface facing the seal seat.

5. Leak test the compressor as described under "Leak Testing The Compressor" later.

6. Roll the felt into a cylinder and slip it into the neck of the compressor top. With a small screwdriver or similar tool, spread the felt so that the ends butt. Using tool (J-9395), tap the felt retaining ring (flange first) into the compressor neck until flush with the end.

7. Reinstall the clutch hub and drive plate.

8. Replace the compressor on the vehicle, and evacuate and charge the system.

PRESSURE RELIEF VALVE

When a faulty pressure relief valve, located in the rear head casting, is encountered, the valve assembly should be removed after purging the system and a new valve and gasket installed. The entire system should then be evacuated and recharged.

COMPRESSOR REAR HEAD AND INTERNAL MECHANISM

Service operations to the rear head or internal mechanism of the compressor should be performed with the compressor removed from the vehicle to ensure that the necessary degree of cleanliness may be maintained.

IMPORTANT

Clean hands and a clean bench, preferably covered with clean paper, are of extreme importance.

REAR HEAD, OIL PUMP, AND VALVE ASSEMBLIES

Removal

1. Remove the compressor from the vehicle, drain compressor oil into a clean container, measure amount removed, clean the exterior of the compressor case and rear head casting with a suitable solvent and mount the compressor, rear head up, in holding fixture (J-9396) which should then be mounted securely in a vise.

2. Remove the four nuts from the shell studs and discard.

3. Remove the rear head. Examine the teflon surface on the casting webs. If this surface is damaged by nicks or scratches, the head should be replaced.

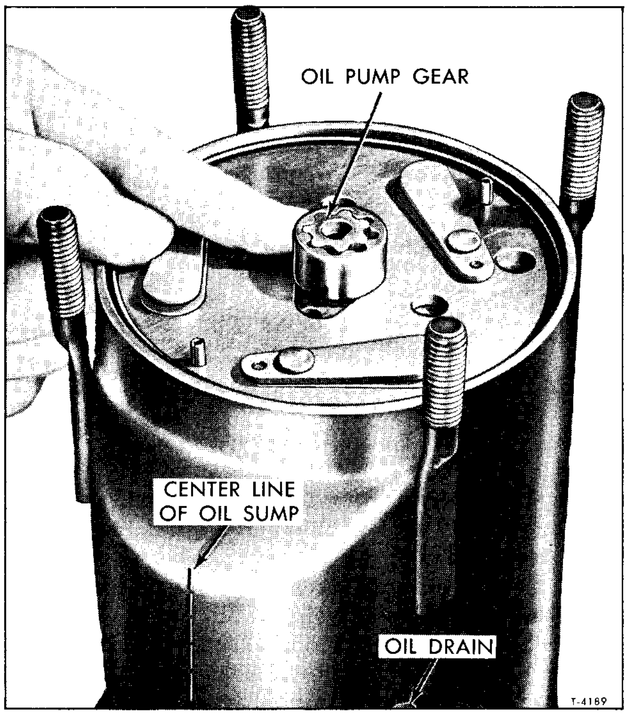

Figure 22—Proper Oil Pump Gear Positioning

4. Examine the suction screen in the rear head for any damage or contamination. Clean or replace the screen as necessary.

5. Remove and examine the oil pump gears. If either of the gears shows any wear or damage, replace both gears.

NOTE: Keep the ends of the two oil pump gears matched and position the same end toward the discharge plate upon reassembly.

6. Remove the rear head-to-shell O-ring and discard.

7. With two screwdrivers, carefully pry up on the rear discharge valve plate assembly (fig. 21). Check for broken reeds or damaged seats and replace entire assembly if such is found.

CAUTION

Excessive force during this operation may loosen valve reed retainer rivets.

8. Carefully lift off the rear suction reed valve. Valve must be replaced if any damage is evident.

Installation

1. Carefully replace the suction reed valve and the rear discharge plate over the dowel pins and ports in the cylinder assembly. Proper positioning of the reed plate may be determined by lining up the proper opening in the plate with the discharge cross-over tube opening.

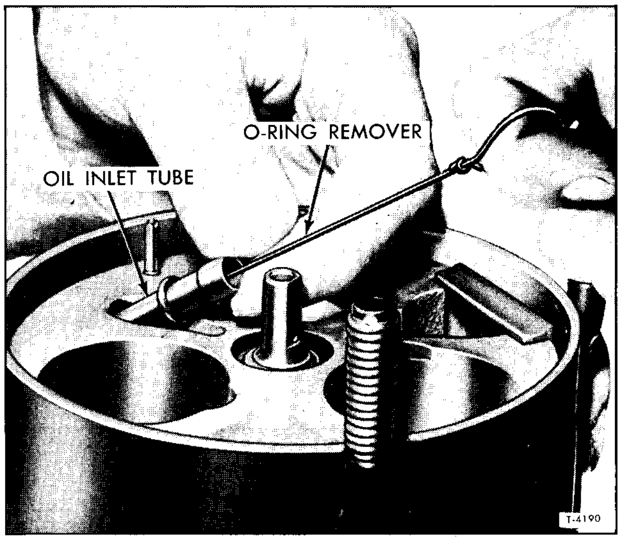

Figure 23—Removing Oil Inlet Tube and O-Ring

2. Position the rear head casting to align with the dowel pins. The two lower mounting pads will be in alignment with the oil sump in the shell. Rotate the cylinder assembly back and forth by hand, if necessary, to permit this alignment. Remove the rear head for this trial assembly.

3. Install the inner oil pump gear over the flat on the shaft and place the outer oil pump gear over the inner gear. Position the outer gear as follows:

a. Observe position of oil sump in the shell.

b. Locate the approximate center line of sump pump.

c. Facing the center line of the sump and viewing from the sump side (bottom) of the compressor, move the OUTER gear toward the right (side having the oil drain fitting) until it is at approximately 90 degrees (3 o'clock position) from the center line of the oil sump (fig. 22).

4. Coat new O-ring with clean refrigeration oil and generously lubricate the area around the outer edge of the valve plate where the O-ring will be placed. Oil also the oil pump gears, valve reeds and the area where the teflon gasket will contact the valve plate.

5. Install the head-to-shell O-ring.

6. Be sure that the suction screen is properly positioned in the rear head, then assemble the rear head to the compressor shell being careful not to damage the teflon gasket.

CAUTION

Be sure head does not bind against oil pump gears when being installed.

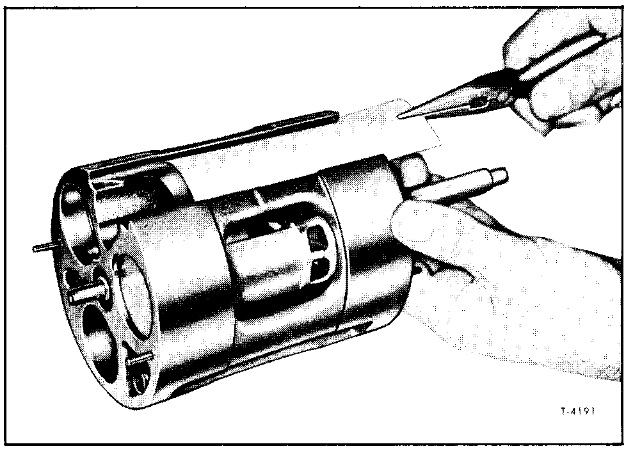

Figure 24—Removing Suction Cross-Over Cover

7. Install new nuts to the threaded shell studs and tighten to 19-25 foot-pounds torque.

8. Leak test the compressor as outlined under "Leak Testing The Compressor" in this supplement.

9. Install compressor in the vehicle.

MAJOR INTERNAL MECHANISM

The clutch hub and drive plate assembly, drive key, pulley and coil housing should be removed before proceeding with compressor disassembly.

Removal From Shell

1. Remove the rear head, discharge plate and suction reed valve from the compressor as outlined previously under "Rear Head Oil Pump and Valve Assemblies."

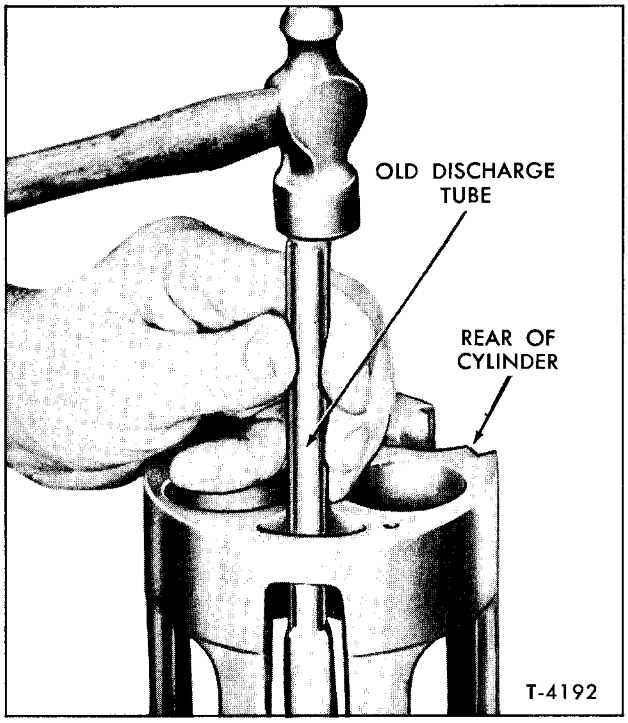

Figure 25—Unseating Discharge Cross-Over Tube

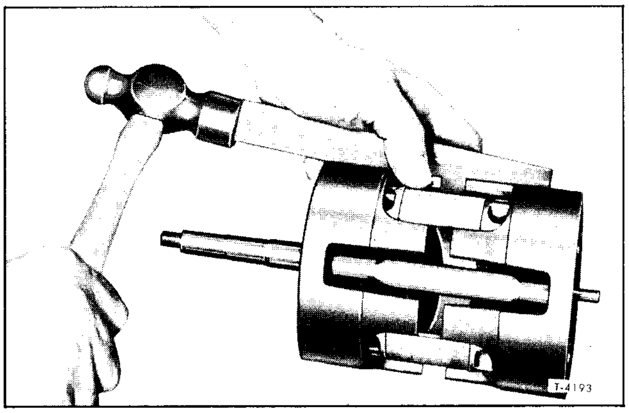

Figure 26—Separating Cylinder Halves

2. Remove the oil inlet tube and O-ring with tool (J-5139) as shown in figure 23.

3. Carefully lay the compressor shell on its side and slide out interior mechanism and front head assembly. Do not hammer or use undue force to remove the mechanism; however, gentle taps on the head casting (not the end of the shaft) may aid in removing the assembly.

4. Remove front head casting, front discharge valve plate and suction reed valve from the mechanism. Examine parts for damage and replace if necessary. Check particularly for damage to the teflon surfaces on the front head casting webs.

5. Examine the mechanism for any obvious damage.

6. Remove the suction cross-over cover (fig. 24).

7. If desired, the mechanism may be assembled in checking cage (J-9397) and operated on a motor test stand, or by some other suitable means, to observe sound level and general operation. Tighten cage nuts evenly to 14-16 foot-pounds torque.

8. Remove mechanism from the cage.

Disassembly

If the mechanism has sustained major damage, due possibly to loss of refrigerant and/or oil, it may be necessary to replace it with a complete service interior mechanism assembly rather than to replace individual parts. If further disassembly is considered worthwhile, proceed as follows:

1. Before disassembling cylinder and mechanism, number the pistons and cylinder locations so that all parts may be replaced in their original location. Pistons and cylinder bores may be identified by numbering them 1, 2, and 3 with a lead pencil.

2. Use an old discharge tube to drive discharge tube out of cylinder (fig. 25). (Drive from REAR of cylinder.)

3. Drive the cylinder halves apart and free from the dowel pins and discharge crossover tube using a fiber block and mallet (fig. 26). Discard the discharge cross-over tube.

NOTE: Before driving cylinder apart, position wobble plate toward front of compressor in area of the cross-over tube.

4. Carefully remove the rear half of the cylinder from the pistons and set the front cylinder half, with the piston, shaft and wobble plate, in fixture (J-9397).

5. Push up on the shaft and, one assembly at a time, remove pistons, rings, seats and balls placing all parts in tray (J-9402) in the compartment associated with the proper end of the piston. Discard all piston ball seats.

NOTE: The front of the piston may be identified by a notch in the casting web (see fig. 27). The piston compartments in tray (J-9402) have a boss at this notch location to indicate the front.

6. Remove and inspect all piston rings. Replace all broken or damaged rings. Damaged pistons must also be replaced.

7. Examine piston balls. Replace if they show burning or excessive wear.

8. Remove the rear combination of thrust races and bearing from the shaft and discard all three pieces.

9. Remove the shaft and wobble plate assembly from the front half of the cylinder.

10. Remove the front combination of thrust washers and bearing and discard all three pieces.

11. Examine all surfaces of the wobble plate and, if satisfactory, reuse. If it shows signs of wear, replace the shaft and wobble plate as an assembly. Use care not to move wobble plate on the shaft. This is factory set.

12. Examine the front and rear cylinder halves and replace as a set if cylinder bores are deeply scored or damaged.

13. Wash all parts to be reused in a suitable cleaner. Blow all parts dry.

14. If cylinder main bearings are to be replaced they may be removed and reinstalled at this time using tool (J-9432). Drive against the lettered end of the bearings and from the outside of the cylinder. Bearing must not be more than 1/8" below surface.

Gauging Procedure

The gauging operations which follow have been worked out on a simple basis to establish and provide necessary running clearances. Two gauging procedures are necessary.

The first gauging operation is made to choose the proper size ball seats to provide, at each piston, a 0.0005" to 0.0010" total preload between the seats and the wobble plate at the tightest place through the 360 degree rotation of the wobble plate. The bronze ball seats are provided in 0.0005" variations including a basic ZERO seat.

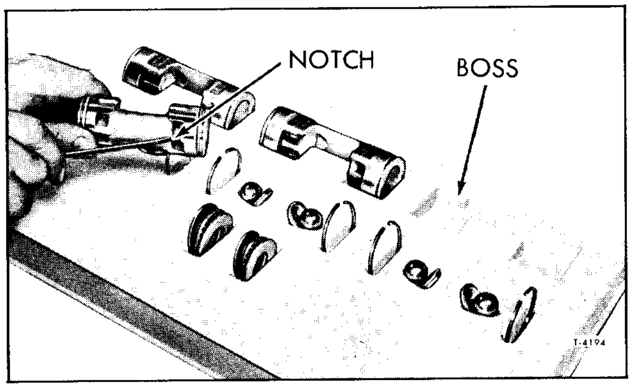

Figure 27—Notch Identifying Front of Piston

The second gauging operation, performed at the rear shaft thrust bearing and race pack, is designed to obtain 0.0005" to 0.0015" preload between the hub surfaces of the wobble plate and the front and rear hubs of the cylinder. A total of 14 steel thrust races, including a basic ZERO race, are provided in increments of 0.0005" thickness to provide the required fit. Proper selection of thrust races and ball seats is of extreme importance.

1. Secure from service parts stock:
   Four - ZERO thrust races
   Three - ZERO ball seats
   Two - New thrust bearings

2. Assemble a ZERO thrust race, a new needle thrust bearing and another ZERO thrust race, in

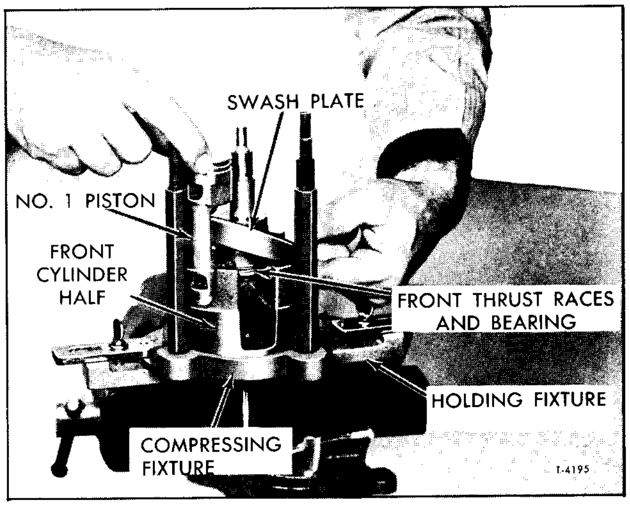

Figure 28—Installing Piston Front Ball and Seat and Rear Ball

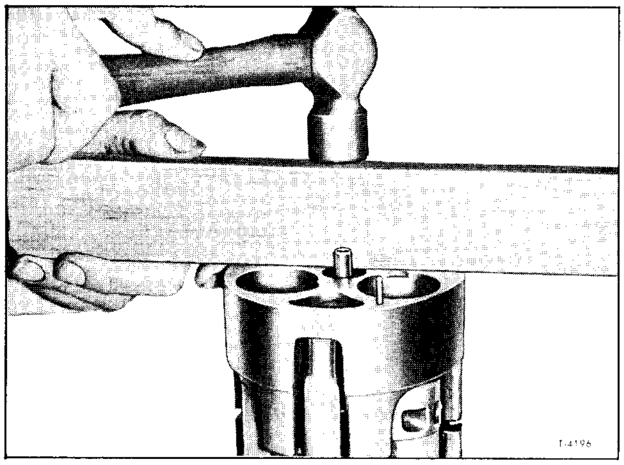

Figure 29—Assembling Cylinder Halves

that order, to front end of the shaft. (A dab of petroleum jelly will hold the bearing-race pack together and in place of shaft.) Lubricate front and rear faces of wobble plate with refrigeration oil.

3. With the front half of the cylinder assembly resting on tool (J-9397), insert the shaft, threaded end through the front main bearing until the thrust race assembly rests on the front cylinder hub.

4. Assemble a ZERO thrust race, a new needle bearing and a second ZERO thrust race in that order, to the rear of the shaft.

5. Apply a light smear of clean petroleum jelly to the ball pockets of each of the three pistons.

6. Place the balls in the piston pockets. The petroleum jelly will hold the balls in place.

7. Apply a light smear of petroleum jelly to the cavity of three new ZERO ball seats and place one seat over each front piston ball. There should now be a ball and seat in the front ball pocket of each piston and a ball only in the rear ball pocket.

NOTE: DO NOT assemble any of the piston rings at this time.

8. Rotate the shaft and wobble plate until the high point of the wobble plate is directly over the cylinder bore previously designated as No. 1. Lift up slightly on the shaft and wobble plate assembly, insert the front (notched) end of the No. 1 piston into the cylinder bore, and at the same time, place the front ball and seat and the rear ball only over the wobble plate (fig. 28). Hold front thrust bearing pack tight against wobble plate hub while lifting shaft.

9. Repeat this operation with pistons Nos. 2 and 3.

10. Align the rear head casting with bores, suction passage, discharge cross-over holes, and dowel pins. Tap into place, using a plastic block and mallet (fig. 29).

11. Place the cylinder assembly in the checking cage with the front of the compressor shaft pointing up, positioning the discharge tube opening between the cage bolts. This will provide access for the feeler gauge. Assemble the cage and tighten all nuts evenly to 14-16 foot-pounds torque.

12. Use a leaf-type feeler gauge and a suitable spring scale to check clearance between the REAR ball and the wobble plate (fig. 30) of the No. 1 piston. Use a suitable combination of feeler gauge leafs until 4 to 8 ounces of force is required to pull gauge from between the ball and the plate.

NOTE: Use undamaged feeler gauges generously lubricated with refrigeration oil. Support the spring scale so that only the actual force required to pull the feeler gauge free is measured.

13. Rotate the shaft approximately 120 degrees and again check with a feeler gauge between the parts. Rotate the shaft another 120 degrees and make a third check. From this total of three feeler gauge checks, use the MINIMUM reading to select a numbered seat to correspond to the feeler gauge reading (i.e. - if minimum reading was 0.019", use a No. 19 seat. If reading was 0.0195", use a No. 19½ seat). Place this seat in the parts tray in the compartment corresponding to the rear ball position of the No. 1 piston.

14. Repeat the operation described in Steps 12 and 13 for pistons No. 2 and No. 3.

15. The next gauging operation is to determine the space between the REAR thrust bearing and the upper (outer) rear thrust race. Use a suitable combination of feeler gauge leafs so that 4 to 8 ounces of force is required to pull gauge free (fig. 31). Select a numbered thrust race to correspond to this feeler gauge reading and place this race in parts tray in the rear thrust race compartment.

16. Loosen the nuts and ring from the checking cage.

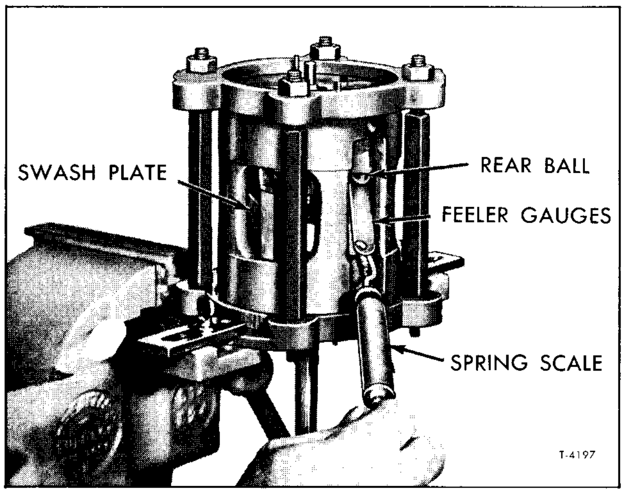

Figure 30—Checking Clearance Between Rear Ball and Wobble Plate

17. Drive the cylinder halves apart, using a fiber block and mallet.

18. Carefully remove the rear half of the cylinder and set the front half (including the pistons and shaft and wobble plate assembly) on fixture (J-9397).

19. Carefully remove one piston at a time from the wobble plate and the front half of the cylinder. Transfer each piston, ball and seat to its proper place in the parts tray along with the numbered rear seat chosen in Steps 12, 13, and 14.

CAUTION

When the balls and seat are removed from the piston, be sure that they are placed in the proper parts tray pocket so as not to lose the relationship of the balls and seats to the proper end of the piston.

20. Remove the rear outer (upper) ZERO thrust race from the compressor shaft and replace it with the numbered thrust race (determined in Step 15 previously) from the parts tray.

NOTE: This ZERO thrust race may be put aside for reuse in future gauging and/or rebuild operations.

21. The gauging operations are now complete.

Assembly

After properly performing the gauging procedure and choosing the correct ball seats and thrust races as outlined under "Gauging Procedure," the cylinder assembly may be reassembled. Be sure to install all new seals and O-rings. All are included in the compressor seal service kit.

1. Support the front half of the cylinder assembly on fixture (J-9397) and install the shaft and wobble plate, threaded end down, with its front bearing race pack (ZERO race, bearing and ZERO race) and its rear bearing race pack (ZERO race, bearing, numbered race) if this was not already done at the end of the "Gauging Procedure."

2. Assemble a piston ring, scraper groove toward the center of the piston, to each end of the three pistons.

3. Apply a light smear of petroleum jelly to the numbered ball seats chosen in the gauging procedure and install all balls and seats (if removed in Step 19 of the gauging procedure) in their proper place in the piston.

4. Rotate the wobble plate so that the high point is above cylinder bore No. 1. Carefully assemble piston No. 1, complete with ball and ZERO seat on the front and ball and numbered seat on the rear, over the wobble plate. Hold front thrust pack tight against wobble plate hub while lifting hub. Compress and enter the piston ring into the front cylinder half.

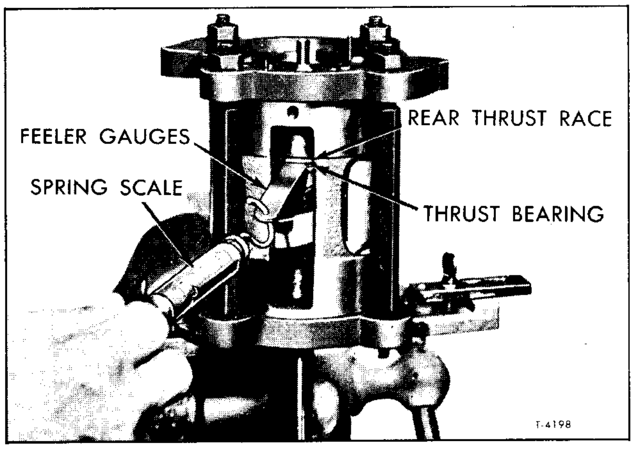

Figure 31—Checking Clearance Between Rear Thrust Bearing and Outer Thrust Race

5. Repeat this operation for pistons No. 2 and No. 3.

6. Assemble one end of a service discharge cross-over tube into the hole in the front cylinder half.

7. Rotate the shaft to position the pistons in a stair-step arrangement, then carefully place the rear cylinder half over the shaft and start the pistons into the cylinder bores.

8. Compress the piston ring on each piston

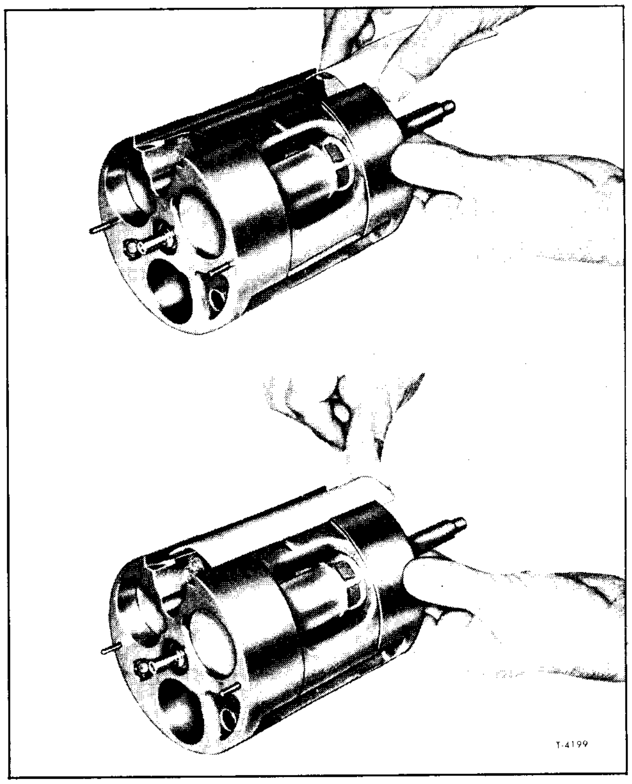

Figure 32—Installing Suction Cross-Over Cover

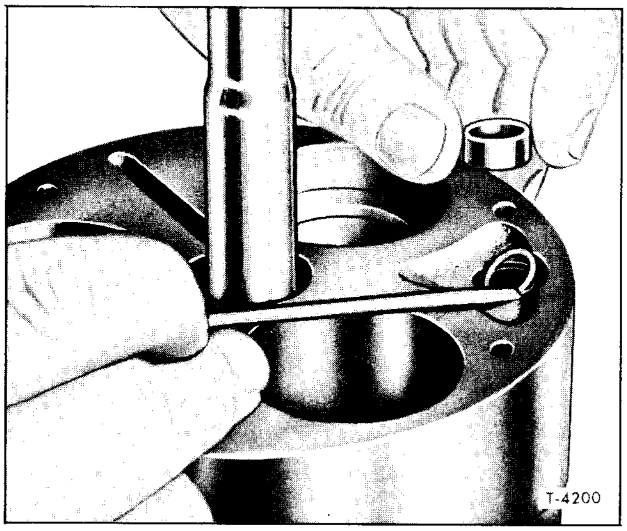

Figure 33—Installing Discharge Cross-Over Tube, Front O-Ring, and Spacer

to permit its entrance into the cylinder.

9. When all three pistons and rings are in their respective cylinders, align the end of the discharge cross-over tube with the hole in the rear half of the cylinder.

NOTE: Be sure the flattened portion of this tube faces the inside of the compressor to allow for wobble plate clearance.

10. When all parts are in proper alignment, tap with a fiber block and mallet to seat the rear half of the cylinder over the locating dowel pins. If necessary, clamp the cylinder in compressing fixture (J-9397) to complete drawing the cylinder halves together.

11. Generously lubricate all moving parts with clean refrigeration oil and check for free rotation of the parts.

NOTE: It may be desirable to clamp the cylinder assembly in compressing fixture (J-9397) and check on the motor test stand for proper operation before proceeding further. If any improper operation is observed, the mechanism should be regauged to ensure proper operation. Complete the assembly procedure when correct operation is obtained.

12. Replace the suction cross-over cover as shown in figure 32. Compress the cover as shown to start it into the slot and then press it in until flush on both ends.

Installation Into Shell

1. Support the cylinder on fixture (J-9521) with the threaded end of the shaft up.

2. Assemble the two dowel pins in the front cylinder if they are not already in place.

NOTE: A rod drilled ¼" deep to the O.D. of the dowel pins will aid in installing.

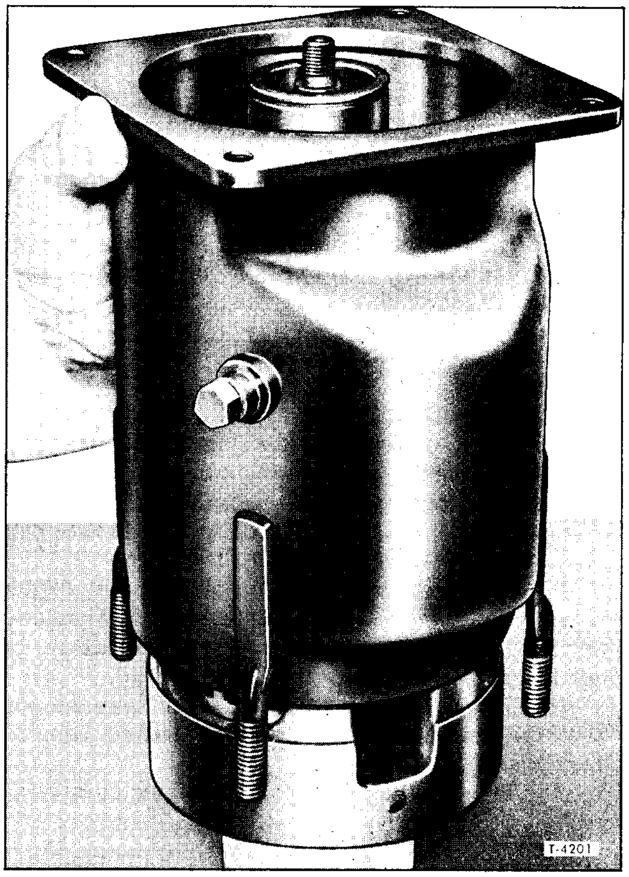

Figure 34—Installing Shell Over Internal Mechanism

3. Install the discharge cross-over tube front O-ring and spacer (fig. 33).

4. Aligning the dowel pin holes, discharge cross-over and oil return slot, assemble the suction reed valve to the front end of the cylinder.

5. Assemble the front discharge valve plate, aligning the holes with the dowel pins and proper opening in the head.

NOTE: The front discharge plate has a larger diameter hole in the center than the rear discharge plate.

6. Check the surface on the compressor front head casting webs and replace the entire casting if there is any evidence of damage. Discard the O-ring.

7. Coat the valve plate with clean refrigeration oil. Rotate the front head casting until it is properly positioned over the discharge reed retainers and dowel pins, then set it in place (being careful not to damage the teflon surfaces) and lightly seat it over dowels with light mallet taps.

NOTE: Dowel pin and hole location can be marked with pencil to aid in locating the proper position.

8. Apply clean refrigeration oil to a new O-ring and O-ring groove at the lower edge of the

front head casting and carefully assemble the O-ring in the groove.

9. Coat the inside machined surfaces of the compressor shell with refrigeration oil.

10. Locate the oil intake tube in the rear discharge plate. Line up the oil sump with this hole location and slide the shell down over the mechanism while supporting the mechanism on support block (J-9521) (fig. 34).

11. Place compressor holding fixture (J-9396) in a vise and, carefully inverting the compressor shell with the mechanism inside, mount the front compressor flange on the support bracket.

12. Place a new O-ring in the oil intake tube hole applying clean refrigeration oil to the oil intake tube hole and the O-ring. Rotating the compressor oil sump baffle, install the pickup tube. Be sure that the O-ring and intake tube are properly seated.

13. Assemble the dowel pins into the rear cylinder.

14. Install the discharge cross-over tube rear O-ring and spacer.

15. Replace the rear suction reed valve, rear discharge valve plate, oil pump gears, rear head and head nuts as outlined previously under "Rear Head and Reed Assemblies - Installation."

LEAK TESTING THE COMPRESSOR

When service operations are performed on the compressor shaft seal assembly or on the interior mechanism, use the following procedure to leak test the reassembled compressor.

1. Install O-rings and cover plate (J-9527) over the suction and discharge ports of the compressor head.

2. Hook up a Refrigerant-22 container and charging line using adapter (J-5420) to cover plate fitting over the suction port. Charge the compressor up to can pressure, then leak test compressor with a leak detector. Turn off the refrigerant container valve. Transfer gauge line and adapter to cover plate fitting over the discharge port and repeat the procedure outlined in Step 2.

3. Correct any leaks present.

System Services and Tests

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PREPARING SYSTEM FOR OPERATION

When air conditioning units have been inoperative during the off-season, certain inspection and service operations must be accomplished before system is placed back in operation.

1. If compressor has been overhauled, make sure proper amount of oil has been replaced in compressor.

2. Charge compressor with refrigerant to provide internal pressure. Refer to "Charging System" later in this section. Check for evidence of oil or refrigerant leakage past the compressor crankshaft seal using a leak detector. If seal leaks,

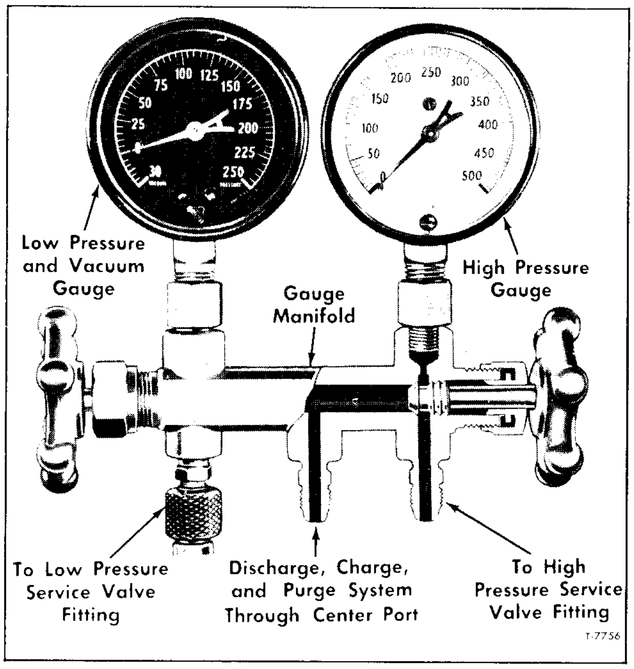
Low Pressure and Vacuum Gauge
Gauge Manifold
High Pressure Gauge
To Low Pressure Service Valve Fitting
Discharge, Charge, and Purge System Through Center Port
To High Pressure Service Valve Fitting
T-7756

Figure 35—Refrigerant Pressure Gauge Set (Typical)

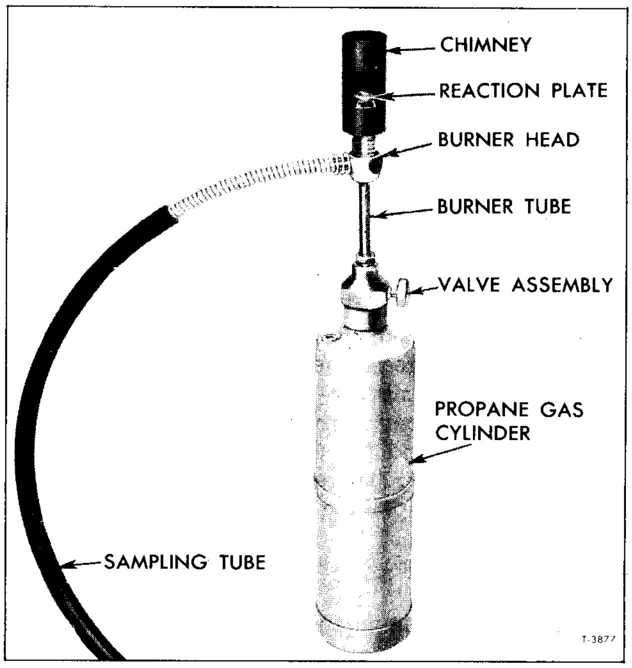

Figure 36—Leak Detector (Typical)

remove compressor and replace seal.

3. Clean condenser coil as instructed later under "Cleaning Coils of Condenser."
4. Check and adjust compressor drive belt tension as explained previously under "Compressor Maintenance."
5. Connect feed wire to compressor clutch coil.
6. Install new dehydrator-strainer unit. Refer to "Replacing Dehydrator-Strainer" in "SYSTEM SERVICES AND TESTS" in AIR CONDITIONING - MODEL PD-4905 previously.
7. Place suction and discharge valves, at rear of compressor, in operating position as explained later under "Refrigerant Valves."
8. Open refrigerant receiver tank valves.

OFF SEASON OPERATION OF SYSTEM

The system should be ready to operate at any time. Therefore, the complete system will only require normal preventive maintenance attention. Regardless of the type of operation, and especially during the off-season, the system should be operated periodically. By operating system weekly at short intervals (5 to 10 minutes) the year around the internal parts of the refrigerant compressor will remain thoroughly lubricated. This will also prevent compressor shaft seal leakage and any loss of refrigerant will be detected at an early stage.

As a precautionary measure during the winter months and prior to operating the compressor, the coach interior should be warmed up to normal operating temperature. Unless this precaution is taken, it is possible to force liquid refrigerant into the compressor, causing severe damage.

CLEANING COILS OF CONDENSER

At regular coach service intervals, check condenser coil external surfaces for dirt or other foreign matter. A clogged coil will cause high discharge pressure and insufficient cooling. Remove filter screen and flush from inner side of coil using water, or water mixed with air pressure.

IMPORTANT: DIRECT PRESSURE STRAIGHT THROUGH COIL TO PREVENT BENDING OF FINS AND DO NOT USE EXTREMELY HIGH PRESSURE, HOT WATER OR STEAM.

USING REFRIGERANT PRESSURE GAUGE SET

The gauge set shown in figure 35 is one tool that is definitely essential for servicing the air conditioning system. It is used when charging, evacuating and for diagnosing trouble in the system.

Gauge set can usually be obtained through a local refrigeration sales and service dealer.

The pressure gauge unit at the left side of set is the low pressure gauge with face graduated in pounds of pressure from 0 to 250 in 5-pound graduations; and, in the opposite direction, in inches of vacuum from 0 to 30 inches.

IMPORTANT: THIS GAUGE UNIT MUST ALWAYS BE USED IN CHECKING PRESSURE ON THE LOW PRESSURE SIDE OF SYSTEM.

The pressure gauge unit at right side of set is the high pressure gauge with face graduated in pounds of pressure from 0 to 500 in 5-pound graduations.

IMPORTANT: THIS GAUGE UNIT SHOULD ALWAYS BE USED IN CHECKING PRESSURE ON THE HIGH PRESSURE SIDE OF SYSTEM.

Three line fittings at bottom of gauge manifold are for purposes explained in figure 35.

NOTE: When center line is not being used, the connected line itself or the line fitting should be capped.

The hand shut-off valves do not have anything to do with opening or closing off pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operations, the valves must be closed. The only occasion for opening both at the same time would be when evacuating system.

IMPORTANT

When gauge set is being connected to system which is charged, the gauge lines MUST always be purged. Purging is done by "cracking" each valve on the gauge set to allow the pressure of system refrigerant to force air to escape through center manifold sitting. Failure to purge lines will result in air or other contaminants entering the system.

NOTE: To prevent gauges from getting out of calibration, handle carefully, and when not in use store gauge set in a safe place.

LEAK TESTING THE SYSTEM

Whenever a refrigerant leak is suspected in the system or a service operation performed which results in disturbing lines or connections, it is advisable to test for leaks. Common sense should be the governing factor in performing any leak test, since the necessity and extent of any such test will, in general, depend upon the nature of the complaint and the type of service performed on the system. It is better to test and be sure, if in doubt, than to risk the possibility of having to do the job over again.

NOTE: The use of a leak detecting dye within the system is not recommended because of the following reasons:

1. Refrigerant leakage can exist without any oil leakage. In this case the dye will not indicate the leak, however, a torch detector will.
2. The addition of additives, other than inhibitors, may alter the stability of the refrigeration system and cause malfunctions.
3. Dye type leak detectors which are insoluble form a curdle which can block the inlet screen of the expansion valve.

LEAK DETECTOR

Tool J-6084 (fig. 36) is a propane gas-burning torch which is used to locate a leak in any part of the system. Refrigerant gas drawn into the sampling tube attached to the torch will cause the torch flame to change color in proportion to the size of the leak. Propane gas fuel cylinders used with the torch are readily available commercially throughout the country.

CAUTION

DO NOT use lighted detector in any place where combustible or explosive gases, dusts, or vapors may be present.

Operating Detector

1. Open control valve only until a low hiss of gas is heard, then light gas at opening in chimney.
2. Adjust flame until desired volume is obtained. This is most satisfactory when blue flame is approximately 3/8" above reactor plate. The reaction plate will quickly heat to a cherry red.
3. Explore for leaks by moving the end of the sampling hose around possible leak points in the system. Do not pinch or kink hose.

NOTE: Since R-22 is heavier than air, it is good practice to place open end of sampling tube immediately below point being tested, particularly in cases of small leaks.

CAUTION

DO NOT breathe the fumes that are produced by the burning of R-22 gas in the detector flame, since such fumes can be toxic in large concentrations.

4. Watch for color changes. The color of the flame which passes through the reaction plate will change to yellow when sampling hose draws in very small leaks of R-22. Large leaks will be indicated by a change in color to a vivid purplish-blue. When the sampling hose passes the leak, the flame will clear to an almost colorless pale-blue again. If the flame remains yellow when unit is removed from leak, insufficient air is being drawn in or the reaction plate is dirty.

NOTE: A refrigerant leak in the high pressure side of the system may be more easily detected when, if possible, the system is in operation. A leak on the low pressure side may be most easily detected after the engine has been shut off for several minutes to allow system pressures to equalize. This particularly applies to the front seal.

PUMPING DOWN THE SYSTEM

In order to accomplish any operations on the system which necessitate disconnecting refrigerant lines, it is necessary to first pump down the system to prevent appreciable loss of refrigerant. To pump down the system means to pump most of the refrigerant into the liquid receiver tank.

1. Install a test manifold with compound and high pressure test gauges on the compressor service fittings.
2. Close the outlet valve on the receiver tank.
3. Connect a jumper wire across the low pressure switch points.
4. Operate the compressor until the compound pressure gauge registers zero.
5. After about thirty (30) seconds, if pressure on compound gauge rises above 10 psi, repeat Step 4, as required, until pressure does not exceed 2 or 3 psi.
6. Close receiver tank and compressor inlet valves by turning clockwise to full "OFF" position.
7. Do not close compressor outlet valve. High pressure test gauge connected to this valve is reading actual pressure of refrigerant in compressor, condenser and lines leading to and from condenser. This refrigerant cannot be pumped down but must be released before opening the system.
8. Remove center hose from the test manifold and open valve on high pressure side of manifold. This will allow remaining refrigerant in the condenser and lines to escape to atmosphere.
9. When indicator on high pressure gauge drops to zero, refrigerant lines on either low or high side may be safely removed. The only unit now containing refrigerant is the sealed-off liquid receiver tank.

IMPORTANT: If lines to be opened to atmosphere are colder than the ambient air temperature, a considerable amount of sweating will take place on inside of lines. ALWAYS ALLOW REFRIGERANT PIPING AND UNITS TO WARM UP TO THE AMBIENT AIR TEMPERATURE BEFORE OPENING THE SYSTEM.

DEPRESSURIZING THE SYSTEM

Any time the system is to be opened, it must first be depressurized. Depressurize the system as follows:

NOTE: Install gauge set to compressor gauge fittings.

1. Remove caps from gauge fittings at compressor.
2. With both valves on the manifold gauge set (J-5725) closed (clockwise), attach manifold hoses to compressor fittings, using Schrader valve adapter (J-5420) at the suction gauge fitting and Schrader valve adapter (J-9459) at the discharge gauge fitting.
3. Crack open the high pressure valve on the manifold gauge set to allow slow escape of refrigerant from the system through the manifold gauge set and out the center fitting and hose. (Place end of hose in clean container.) If oil drips from the hose into the container, refrigerant is escaping too rapidly.
4. When hissing ceases (indicating all refrigerant has escaped) close valves on manifold gauge set by turning valve clockwise.

DISCHARGING THE SYSTEM (TO ATMOSPHERE)

1. Remove valve cover on service port of valve, then connect a long hose on to self sealing valve.

NOTE: If possible, place opposite end of hose at opening of an exhaust ventilating system. NEVER DISCHARGE REFRIGERANT INTO CLOSED AREA AS POSSIBLE SUFFOCATION COULD OCCUR.

2. Allow refrigerant to discharge slowly.

NOTE: If allowed to discharge rapidly, compressor oil may foam and be discharged also.

3. After discharging to proper charge or discharging system completely, remove the hose, and then install protector cap over valve.
4. If system was discharged completely, it can now be opened for parts replacement or any other reason.

EVACUATING THE SYSTEM

When the refrigeration system is depressurized and opened for service, some air will enter the lines regardless of how quickly the openings are capped. In order to remove this air and as much as possible of the moisture it contains, the complete system must be "evacuated." Evacuating is merely the process of removing all air from the system, thereby creating a vacuum in the system.

1. Install test dehydrator strainer in liquid line.

NOTE: Test strainer is a standard dehydrator-strainer that is discarded after being used twice.

2. Check for loose refrigerant line connections.
3. Remove all four (4) caps from compressor and from receiver valves.
4. Turn all valves all the way out (counterclockwise).

pounds of pressure from 0 to 250 in 5-pound graduations; and, in the opposite direction, in inches of vacuum from 0 to 30 inches.

IMPORTANT: THIS GAUGE UNIT MUST ALWAYS BE USED IN CHECKING PRESSURE ON THE LOW PRESSURE SIDE OF SYSTEM.

The pressure gauge unit at right side of set is the high pressure gauge with face graduated in pounds of pressure from 0 to 500 in 5-pound graduations.

IMPORTANT: THIS GAUGE UNIT SHOULD ALWAYS BE USED IN CHECKING PRESSURE ON THE HIGH PRESSURE SIDE OF SYSTEM.

Three line fittings at bottom of gauge manifold are for purposes explained in figure 35.

NOTE: When center line is not being used, the connected line itself or the line fitting should be capped.

The hand shut-off valves do not have anything to do with opening or closing off pressure to the gauges. They merely close each opening to the center connector and to each other. During most diagnosing and service operations, the valves must be closed. The only occasion for opening both at the same time would be when evacuating system.

IMPORTANT

When gauge set is being connected to system which is charged, the gauge lines MUST always be purged. Purging is done by "cracking" each valve on the gauge set to allow the pressure of system refrigerant to force air to escape through center manifold sitting. Failure to purge lines will result in air or other contaminants entering the system.

NOTE: To prevent gauges from getting out of calibration, handle carefully, and when not in use store gauge set in a safe place.

LEAK TESTING THE SYSTEM

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NOTE: The use of a leak detecting dye within the system is not recommended because of the following reasons:

1. Refrigerant leakage can exist without any oil leakage. In this case the dye will not indicate the leak, however, a torch detector will.
2. The addition of additives, other than inhibitors, may alter the stability of the refrigeration system and cause malfunctions.
3. Dye type leak detectors which are insoluble form a curdle which can block the inlet screen of the expansion valve.

LEAK DETECTOR

Tool J-6084 (fig. 36) is a propane gas-burning torch which is used to locate a leak in any part of the system. Refrigerant gas drawn into the sampling tube attached to the torch will cause the torch flame to change color in proportion to the size of the leak. Propane gas fuel cylinders used with the torch are readily available commercially throughout the country.

CAUTION

DO NOT use lighted detector in any place where combustible or explosive gases, dusts, or vapors may be present.

Operating Detector

1. Open control valve only until a low hiss of gas is heard, then light gas at opening in chimney.
2. Adjust flame until desired volume is obtained. This is most satisfactory when blue flame is approximately 3/8" above reactor plate. The reaction plate will quickly heat to a cherry red.
3. Explore for leaks by moving the end of the sampling hose around possible leak points in the system. Do not pinch or kink hose.

NOTE: Since R-22 is heavier than air, it is good practice to place open end of sampling tube immediately below point being tested, particularly in cases of small leaks.

CAUTION

DO NOT breathe the fumes that are produced by the burning of R-22 gas in the detector flame, since such fumes can be toxic in large concentrations.

4. Watch for color changes. The color of the flame which passes through the reaction plate will change to yellow when sampling hose draws in very small leaks of R-22. Large leaks will be indicated by a change in color to a vivid purplish-blue. When the sampling hose passes the leak, the flame will clear to an almost colorless pale-blue again. If the flame remains yellow when unit is removed from leak, insufficient air is being drawn in or the reaction plate is dirty.

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1. Install a test manifold with compound and high pressure test gauges on the compressor service fittings.
2. Close the outlet valve on the receiver tank.
3. Connect a jumper wire across the low pressure switch points.
4. Operate the compressor until the compound pressure gauge registers zero.
5. After about thirty (30) seconds, if pressure on compound gauge rises above 10 psi, repeat Step 4, as required, until pressure does not exceed 2 or 3 psi.
6. Close receiver tank and compressor inlet valves by turning clockwise to full "OFF" position.
7. Do not close compressor outlet valve. High pressure test gauge connected to this valve is reading actual pressure of refrigerant in compressor, condenser and lines leading to and from condenser. This refrigerant cannot be pumped down but must be released before opening the system.
8. Remove center hose from the test manifold and open valve on high pressure side of manifold. This will allow remaining refrigerant in the condenser and lines to escape to atmosphere.
9. When indicator on high pressure gauge drops to zero, refrigerant lines on either low or high side may be safely removed. The only unit now containing refrigerant is the sealed-off liquid receiver tank.

IMPORTANT: If lines to be opened to atmosphere are colder than the ambient air temperature, a considerable amount of sweating will take place on inside of lines. ALWAYS ALLOW REFRIGERANT PIPING AND UNITS TO WARM UP TO THE AMBIENT AIR TEMPERATURE BEFORE OPENING THE SYSTEM.

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3. Crack open the high pressure valve on the manifold gauge set to allow slow escape of refrigerant from the system through the manifold gauge set and out the center fitting and hose. (Place end of hose in clean container.) If oil drips from the hose into the container, refrigerant is escaping too rapidly.
4. When hissing ceases (indicating all refrigerant has escaped) close valves on manifold gauge set by turning valve clockwise.

DISCHARGING THE SYSTEM (TO ATMOSPHERE)

1. Remove valve cover on service port of valve, then connect a long hose on to self sealing valve.

NOTE: If possible, place opposite end of hose at opening of an exhaust ventilating system. NEVER DISCHARGE REFRIGERANT INTO CLOSED AREA AS POSSIBLE SUFFOCATION COULD OCCUR.

2. Allow refrigerant to discharge slowly.

NOTE: If allowed to discharge rapidly, compressor oil may foam and be discharged also.

3. After discharging to proper charge or discharging system completely, remove the hose, and then install protector cap over valve.
4. If system was discharged completely, it can now be opened for parts replacement or any other reason.

EVACUATING THE SYSTEM

When the refrigeration system is depressurized and opened for service, some air will enter the lines regardless of how quickly the openings are capped. In order to remove this air and as much as possible of the moisture it contains, the complete system must be "evacuated." Evacuating is merely the process of removing all air from the system, thereby creating a vacuum in the system.

1. Install test dehydrator strainer in liquid line.

NOTE: Test strainer is a standard dehydrator-strainer that is discarded after being used twice.

2. Check for loose refrigerant line connections.
3. Remove all four (4) caps from compressor and from receiver valves.
4. Turn all valves all the way out (counterclockwise).

CAUTION: In back-seating or closing valve, do not over-tighten or seat will be damaged.

5. Connect special evacuation and charging manifold (without gauges) to connector in liquid line between condenser and receiver, and to connector on receiver inlet valve. To check for blockage in system, turn compressor discharge service valve two turns off backseat and remove core from Schrader valve. Close receiver inlet valve and open condenser outlet valve. Connect (R-22 + N) test line to manifold inlet valve and apply 150# pressure to check Hi-side of system. If gas blows freely from discharge valve connector, close outlet valve at condenser and open inlet valve at receiver to check Lo-side of system. If gas blows freely at discharge valve, backseat discharge valve, replace core and cap. If blockage is indicated, open Hi- or Lo-side line connections as necessary progressively back to compressor to locate and remove blockage.
6. Continue applying 150# pressure and check all connections for leaks. Repair leaks, if any. After leak check, bleed system down to zero pressure.
7. Connect vacuum pump line to manifold (T) inlet valve. Connect absolute MM gauge to connection at compressor suction valve and turn off backseat two turns. Evacuate to 2.5 MM Hg. absolute. Backseat compressor suction valve and break vacuum with 150# of mixture (R-22 + N). Hold this pressure until just before second evacuation, at which time bleed system down to zero atmospheric pressure. Re-evacuate for at least 30 minutes at 2.5 MM Hg. Backseat both valves before shutting off pump. Hold vacuum on system for at least 10 minutes. During this time vacuum must level off at no higher than 5 MM. If system does not hold vacuum, check for leaks, then re-evacuate.
8. If vacuum holds, connect charging line to manifold inlet valve, open valve and charge with R-22. Close valve and remove bulk charge line. Close receiver inlet and condenser outlet valve. Open manifold inlet valve gradually to release pressure. Disconnect manifold while some pressure still exists in liquid line and cap immediately so air will not enter system. If pressure is lost, remove cap from receiver inlet valve connector and purge liquid line by cracking condenser outlet valve. Cap connector while still blowing, then open all valves in system.

CHARGING THE SYSTEM

ADDING SMALL QUANTITIES OF REFRIGERANT TO SYSTEM

NOTE: Before adding any refrigerant to system, make sure all leaks have been located and repaired. Also, level out the system by operating the system for 10 to 20 minutes at approximately 1500 engine rpm.

NOTE: Generally, refrigerant is admitted to the low pressure (suction) side of system in a gas state refrigerant supply tank retained upright. Refrigerant which is admitted too fast into system may cause slugging in the compressor or it may cause oil to leave the compressor.

1. Connect refrigerant gauge set loosely to service fittings on compressor service valves. Make sure gauge lines are connected to respective high and low service fittings.

IMPORTANT: Values at compressor should be backseated before removing valve caps and connecting test gauge lines. After connecting lines, open valves ¼ to ½ turn and purge gauge lines.

2. Connect refrigerant supply tank charging line loosely to center fitting on gauge manifold. Purge air from refrigerant supply line, then retighten line fitting.
3. "CRACK" open the shut-off valves of gauge set. This will purge air out of lines to service valves. Tighten line connections at service valves, then close shut-off valve at high pressure side of gauge set.

NOTE: The high pressure line is hooked up and is purged of air but will not be used until system is charged and final check is made.

4. Open vapor valve on refrigerant tank. Support refrigerant tank in an upright position, then start and operate system at approximately 1500 engine rpm. Engine speed must not be allowed to surge. Open gauge low pressure valve. Refrigerant will be drawn into system through low pressure side of system.

5. Operate system until refrigerant in liquid line sight glass is clear. Coach temperature should be 75° to 80°F., during leveling off, so that all oil will return to compressor.

6. Close supply tank valve, then disconnect lines and remove gauge set. Install protector seals and caps to service fittings.

CHARGING AN EMPTY SYSTEM

A system which has been evacuated can be charged in same manner described previously for "Adding Refrigerant to System." However, if compressor cannot be operated, refrigerant can be transferred from refrigerant tank to system as directed above until refrigerant "HI-LO" pressure switch cuts in and compressor starts to operate. Continue to add refrigerant to system by performing Steps 4 through 6 under "Adding Refrigerant to System."

CHECKING FOR AIR IN SYSTEM

Air in refrigerant system causes excessive head pressures and excessively high operating temperatures.

1. Connect an accurate pressure gauge to high pressure test gauge fitting.
2. Hang an accurate thermometer near intake side of condenser coil.
3. Allow compressor to stand idle for several hours to allow temperatures of all parts to equalize, then note reading on thermometer and reading on gauge.
4. Compare these figures with figures shown in "Pressure Temperature Chart" in "SYSTEM MAINTENANCE" in AIR CONDITIONING - MODEL PD-4905, previously in this supplement. If pressure gauge shows a reading of more than 3 pounds higher than pressure shown on chart for the existing temperature, air must be purged from system.

PURGING AIR FROM SYSTEM

If it is determined that air is present in system as previously described under "Checking For Air In System," check to determine if moisture is also present. If moisture is indicated, evacuate the system and recharge with new refrigerant as instructed under applicable headings in this section. If moisture is not indicated, purge air from system as follows:

1. Place refrigerant valves in open position to admit refrigerant to entire system.
2. To purge air from system, loosen line connections at top of condenser coil. After a small amount of refrigerant gas and air has escaped, tighten connection.
3. Recheck for air in system as previously directed and repeat procedures as required.

ADDING OIL TO COMPRESSOR

NOTE: Compressor requires 11 fluid ounces of 525 viscosity oil. When refrigerant system components other than the compressor are replaced, the compressor must also be removed and oil drained from the compressor. The amount of oil to put back into the compressor is found as follows. DO NOT add any more oil than is necessary or maximum cooling will be reduced.

1. Remove compressor and place in a horizontal position with compressor drain plug downward, drain compressor in an empty graduated bottle, measure amount of oil and discard this oil.
2. If the quantity of oil measured is more than 4 fluid ounces, replace into the compressor the same amount of clean oil as the oil drained, plus the following amount for the refrigeration system component being changed:
   a. Evaporator - 3 fluid ozs.
   b. Condenser - 1 fluid oz.
   c. Receiver-dehydrator assembly - 1 fluid oz.
   Neglect any fluid oil coating loss in case of line change.
3. If the oil quantity drained from the compressor is less than 4 ounces, replace into the compressor 6 fluid ounces of clean oil, plus the amount shown previously for the respective component replacements.
4. Replace compressor and system components.
5. Evacuate, charge and perform operational test.

SUPERHEAT CHECK

Instructions for checking superheat are explained previously under "Expansion Valve" in "SYSTEM MAINTENANCE" in AIR CONDITIONING - MODEL PD-4905, section previously.

REPLACING DEHYDRATOR-STRAINER

Instructions for replacing the dehydrator-strainer are the same as explained under "Replacing Dehydrator-Strainer" in "SYSTEM SERVICES AND TESTS" in AIR CONDITIONING - MODEL PD-4905 covered previously in this supplement.

REFRIGERANT VALVES

Before operating air conditioning system after storage or inactive period and during operation of system, refrigerant valves must be in "OPERATING POSITION." When system has been pumped down and is being prepared for operation, open valves in the following sequence:

1. Receiver Tank Liquid Out Valve - Fully Open. Stem turned counterclockwise.
2. Compressor Suction Valve - Fully Opened and then turned in two full turns.
3. Compressor Discharge Valve - Fully Opened and then turned in two full turns.
4. Receiver Tank Inlet Valve - Fully Open.

NOTE: By opening full and then "cracking" valves two turns, the "Schrader" valves are opened to the refrigerant system, so it is unnecessary to remove valve stem covers and operate valves to make refrigerant system check. Gauge lines must be equipped with "Schrader" valve depressors, or adapter must be used.

REFRIGERANT COMPRESSOR DRIVE BELT

Information applicable to replacing and tightening refrigerant compressor drive belts remains the same as covered under "Compressor Maintenance" previously in this section.

Troubleshooting

Most of any trouble in the air conditioning system will produce the same symptoms - insufficient cooling.

The following, which is more of a quick reference chart, deals with locating and correcting the common causes of insufficient cooling.

NOTE: Detail troubleshooting information of a specific condition, the possible causes of a condition, its symptoms and the recommended action to be taken is shown later on "TROUBLE ANALYSIS CHART".

IMPORTANT

THE MOST COMMON CAUSE OF INSUFFICIENT COOLING IS A DIRTY, CLOGGED CONDENSER COIL. THIS CONDITION SHOULD BE CHECKED FREQUENTLY AND CORRECTED AS EXPLAINED.

CONDITION	REMARK	REF. PAGE
1. Blower Not Running		
a. Loose Electrical Connections	Tighten	-
b. Defective Alternator	Replace	-
c. Defective Blower Motor	Repair	-
2. Dehydrator - Strainer Clogged	Replace	185
3. Air Filter Screen Clogged		140
4. Compressor Valves Not In Operating Position		226
5. Improper Engine Idle Speed		-
6. Low Refrigerant		
a. Leaks in System		-
b. Recharge System		225
7. Expansion Valve Inoperative		
a. Capillary Tube Broken		135
b. Equalizer Tube Restricted		136
c. Gummed Cage		135
d. Check for Proper Superheat		136
e. System Short of Capacity (See "TROUBLE ANALYSIS CHART")		
8. Compressor Clutch Disengaged or Fails to Engage		
a. Dirty Condenser	Clean	222
b. One Fan Motor Not Running		-
c. Too Much Refrigerant		224
d. Air in Refrigerant System		226
e. Worn Clutch Plate	Replace	208
f. Refrigerant Valves Not In Operating Position		204
g. Dehydrator-Strainer Plugged		185
9. Compressor Clutch Disengages or Fails to Engage at High Outside Temperatures (Items a, b, and d above will cause this condition).		

TROUBLE ANALYSIS CHART

This Trouble Analysis Chart is to supply information for trouble-shooting a specific condition, affected mostly by the operation of the refrigerant compressor. It also contains information on conditions affecting pressures within the refrigerant system.

NOTE	POSSIBLE CAUSE	SYMPTOMS	RECOMMENDATIONS	REF. PAGE
1	Frozen compressor due to locked or damaged mechanism	Compressor is noisy or will not operate.	Overhaul compressor	212
2	Broken or sheared compressor drive shaft	Excessive noise, compressor not operating.	Repair	212
3	Clutch drive plate is worn or covered with grease.	Slipping action. Odor or smoke in compartment.	Replace clutch.	208
4	Defective clutch coil	Slipping action, or no engagement	Check coil for short	208
5	Low voltage to clutch coil	Slipping clutch. Odor or smoke in compartment	Check voltage at clutch coil	208
6	Open control circuit a. HI-LO pressure switch defective b. Thermostat switch defective c. AC ON-OFF switch defective.	Open circuit to clutch coil	Check HI-LO pressure switch setting	203
7	Intermittent contact in electrical control circuit. Compressor valves not in operating position.	Compressor intermittently starts and stops.	Repair or replace faulty electrical control. Check for loose wiring connections. Open compressor valves.	204
8	Low pressure switch controller differential set to close.	Frequent starting and stopping.	Check HI-LO pressure switch setting.	203
9	High pressure switch controls differential too close	Frequent starting and stopping.	Replace HI-LO pressure switch assembly	203
10	Dirty or iced evaporator coil.	Reduced air flow. a. Dirty or clogged air filter screen. b. Blower motors not at proper speed. c. Plugged recirculating air ducts.	Clean air filter screen. Check recirculation ducts for obstructions. Check blower motors for proper RPM.	140

TROUBLE ANALYSIS CHART NOTES (CONT'D.)

NOTE	POSSIBLE CAUSE	SYMPTOMS	RECOMMENDATIONS	REF. PAGE
11	Overcharge of refrigerant or noncondensible gas	High discharge pressure	Remove excess refrigerant or purge system	224
12	Lack of refrigerant	Too frequent starting and stopping on low pressure control switch.	Repair refrigerant leak and recharge system	225
13	Clogged refrigerant dehydrator-strainer	Suction pressure too low and frosting at strainer unit.	Replace dehydrator-strainer.	185
14	Faulty operation of refrigerant condensing system	Compressor cuts off and on from high pressure switch		
15	Insufficient Oil	Oil level too low	Add proper amount of compressor oil.	226
16	Traps in hot gas and suction lines	Oil level gradually drops	Recheck lines for possible traps. Lines may have been repositioned when body repairs were made.	-
17	Loose expansion valve remote bulb	Excessive cold suction line	Provide good contact between remote bulb and suction line.	See Remarks 4 and 5 later.
18	Liquid flooding back to compressor	Excessive cold section line. Noisy compressor operation.	Readjust superheat setting and check remote bulb contact.	226
19	Short cycling	Frequent starting and stopping of compressor		203
20	Loose compressor drive belt	Inoperative compressor	Adjust belt tension.	204
21	Internal parts of compressor broken	Noisy compressor	Overhaul compressor	207
22	Expansion valve stuck in open position	Abnormal cold suction line. Compressor knocks.	Repair or replace expansion valve	135

	POSSIBLE CAUSE	SYMPTOMS	RECOMMENDATIONS	REF. PAGE
23	Compressor hold-down mountings loose	Compressor vibrates excessively	Tighten or replace mountings	206
24	Flash gas in liquid line	Expansion valve hisses	Add refrigerant	225
25	Excessive pressure drop in evaporation	Superheat too high	Check superheat and reset expansion valve	See Remarks 2 and 4 later
26	Improper superheat adjustment	Short cycling	Adjust expansion valve	See Remark 4 later.
27	Air or non-condensible gas in system	Exceptionally hot condenser and excessive discharge pressure	Purge system	226
28	Broken or leaky discharge valves within compressor	Suction pressure rises faster than 5 lbs. per minute after pressure shut-down	Overhaul compressor	207
29	Leaky piston heads in compressor	Insufficient cooling	Replace reed valve	212
30	Excessive load on evaporator	Insufficient cooling	Check for air leaks in evaporator compartment. Check air filter screen and blower motors	-
31	Overfeeding of expansion valve	Abnormally cold suction line. Liquid flooding back to compressor	Check contact of expansion valve remote bulb to suction line	See Remarks 4 and 5 later.
32	Broken valves within compressor	Noisy compressor	Overhaul compressor	212
33	Compressor worn	Insufficient cooling	Overhaul compressor	212
34	Expansion valve power unit has lost charge	No flow of refrigerant through valve	Replace expansion valve assembly	135
35	Obstructed expansion valve	Loss of capacity	Clean or replace expansion valve	135
36	Too much pressure through evaporator coil	Superheat too high	Check for plugged external equalizer line at expansion valve	135

TROUBLE ANALYSIS CHART REMARKS

REMARK

NO. 1 - CLOGGED REFRIGERANT DEHYDRATOR-STRAINER

Occasionally the dehydrator-strainer in the liquid line may become clogged with foreign material in the system. When this happens, the liquid line leaving the strainer will feel cooler than the liquid entering. If it is badly clogged, some sweat or frost may appear at strainer outlet.

NO. 2 - REFRIGERANT EXPANSION VALVE STUCK IN OPEN POSITION

If the expansion valve is stuck in an OPEN position, there will be an excessive amount of sweating on the suction line and compressor due to the large amount of liquid being passed into the suction line.

NO. 3 - REFRIGERANT EXPANSION VALVE HAS LOST CHARGE

The power element of expansion valve consists of the remote bulb, capillary tube and the diaphragm, which actuates the valve cage. If this power element is inoperative or has lots its charge, the valve will either maintain an almost closed position or may close completely. Test for an inoperative power element as follows:

a. Stop compressor.
b. Remove remote bulb from clamp on suction line at end of evaporator coil.
c. Carefully place remote bulb in container filled with ice water.
d. Start compressor.
e. Remove remote bulb from ice water and warm in hand. At the same time check suction line for rapid temperature change which indicates flood-through of liquid refrigerant. If refrigerant floods through valve, power unit is operating properly.

WARNING: DO NOT flood-back through suction line for too long a period excessive liquid flood-back could cause severe damage to compressor.

NO. 4 - REFRIGERANT EXPANSION VALVE IMPROPERLY ADJUSTED

If the expansion valve is adjusted for too low a superheat, too much liquid will be passed into evaporator. The suction line will be normally cold and liquid may slug back to the compressor. If expansion valve is adjusted for too high a superheat, too little liquid will be passed to the evaporator and the suction line will be abnormally warm. Superheat must always be adjusted carefully using thermometer and suction gauge.

NO. 5 - REFRIGERANT EXPANSION VALVE IS OBSTRUCTED

Foreign material may obstruct the valve port. If the obstruction is small, the resulting operation will be a "hunting" condition which will cause a suction pressure variation of possibly 10 to 15 PSI on suction pressure test gauge. If the obstruction holds the valve open during shutdown, liquid will flood back to compressor. This causes liquid slugging to compressor at startup, which is definitely harmful. An obstructed expansion valve is usually indicated by a partly warm evaporator and frosting at the evaporator inlet.

NO. 6 - SHORTAGE OF REFRIGERANT

There should always be sufficient liquid in the receiver tank to completely submerge the inlet to the liquid line pipe. If there is a shortage of refrigerant, the liquid level will fall below the inlet to the liquid line and a mixture of gas and liquid will pass into the liquid line. Bubbles will appear in the sight glass, the larger the bubbles the more severe the refrigerant shortage. Frequently there will be a hissing or whistle at the expansion valve. The coil and suction line will be relatively warm while the suction pressure will be low due to little or no liquid being supplied to the evaporator if the shortage is severe.

TROUBLE ANALYSIS CHART REMARKS (CONT.)

NO. 7 - OVERCHARGE OF REFRIGERANT

An overcharge of refrigerant will cause high head pressure. Liquid will back up in the condenser and decrease the amount of surface available for condensing and as a result the head pressure will rise. In extreme cases, it may rise to a point where the high pressure cut-out switch will stop the compressor. This may result in compressor short cycling.

NO. 8 - AIR IN SYSTEM, PURGING

If air or non-condensible gases are present in the system, they will usually tend to move toward and collect at the condenser. The head pressure will rise to a point above the pressure corresponding to the temperature at which the vapor is condensing. In extreme cases, the pressure may rise to a point where high pressure cut-out switch will stop the compressor.

To determine whether or not there is air in the system, the compressor must be allowed to stand idle long enough for the entire system to cool down to the temperature of the surrounding air. After the system has attained the same temperature as the surrounding air, the reading of the head pressure test gauge should not be more than 5 lbs. above the saturation pressure corresponding to the surrounding air temperature. See "REFRIGERANT, PRESSURE-TEMPERATURE RELATIONSHIP" chart, Page 138.

NO. 9 - BROKEN VALVES IN COMPRESSOR

Broken or leaky discharge valves within the compressor are generally indicated by the suction pressure rising rapidly as soon as the compressor is stopped. If the suction pressure rises faster than 5 lbs. per minute, it is an indication that the compressor discharge valves are not holding. Before the compressor is torn down, however, it should be determined that the pressure rise is not due to a leaky expansion valve.

AIR CONDITIONING LUBRICATION AND INSPECTION

The following tabulation lists lubrication and service points, service required and the recommended intervals at which these services should be accomplished. These services should be accomplished at more frequent intervals when system is operated under severe conditions such as extremely high temperatures. References in right-hand column refer to page numbers where service procedures are covered, or to Lubrication Notes below for recommended lubricant and proper application.

ITEM	SERVICE REQUIRED	DAILY	AT INSPECTION	SEE FOOTNOTE	REF. PAGE
Compressor	Check Tightness of Mounting Bolts	-	X	-	206
Liquid Line Sight Glass	Check Refrigerant Charge	X	-	-	222
Condenser	Clean Coils as Necessary	X	-	-	222

AIR CONDITIONING LUBRICATION AND INSPECTION (CONT.)

ITEM	SERVICE REQUIRED	DAILY	AT INSPECTION	SEE FOOTNOTE	REF. PAGE
Dehydrator Strainer	Replace Cartridge		-	(A)	185
Air Filter Screens	Clean and Re-oil		X		140
Evaporator Coil	Clean		X	-	139
HI-LO Pressure Switch	Check Adjustment		X	-	203
Driver's Control Panel	Tighten Connections		X	-	-
Fan Motors	Check for Speed with Strobotac		X	-	-
Belts	Check condition and Tension		X	-	204

(A) Whenever System has Been Opened.

NOTE 1 - COMPRESSOR OIL

A special wax-free, dehydrated 525 viscosity refrigerant type oil must be used.

Oil should be obtained in sealed cans. Never use bulk oil or oil which has been exposed to air for any length of time.

The compressor oil capacity is 11 ounces.

The receiver oil capacity is 44 ounces.

NOTE 2 - ODORLESS OIL

AIR FILTER SCREENS

Thoroughly clean filter screens, then spray, or dip and let drain, with light odorless oil, such as medicinal white oil.

EQUIPMENT AND MATERIALS

The following equipment and materials are required for servicing the Air Conditioning System. The following equipment and materials can be procured locally or from a reliable Air Conditioning Refrigeration supply house.

EQUIPMENT

Thermometer With Remote Reading Dial - For use in conjunction with expansion valve adjustment.

Soldering Torch and Cylinder of Gas - For soldering refrigerant line fittings.

Leak Detector - For detecting refrigerant leaks.

Vacuum Pump - For evacuating the system. Must be capable of producing ultimate vacuum of less than 1 MM Hg. absolute.

Vacuum Gauge - For checking ultimate vacuum during evacuation. Must be readable to 1 MM Hg. absolute.

Pressure and Vacuum Gauge Set - For checking Refrigerant-22 system operation.

- With compound gauge:
  - -0 to 30" vacuum scale.
  - -0 to 250 lbs. pressure scale.
- With high pressure gauge:
  - -0 to 500 lbs. scale.

MATERIALS

Fuel - For use in leak detector.

Refrigerant-22 - Monochlorodifluoromethane. Do not use any other type of refrigerant in this system. (Approximately 25 lbs. required in system, available in various size containers.

Solder - 95% tin and 5% antimony - For soldering refrigerant line fittings.

Nokorode Soldering Paste - For use on soldered fittings.

TORQUE SPECIFICATIONS

Compressor Suction and Discharge Connector Bolt	20 Ft.-Lbs.
Rear Head to Shell Stud Nuts	20 Ft.-Lbs.
Shaft Mounting Nut	15 Ft.-Lbs.
Cage Nuts	16 Ft.-Lbs.

SPECIAL TOOLS

References are made to Special Tools throughout this section. These tools, or their equivalent, are necessary and are recommended to readily and efficiently accomplish certain overhaul operations. The tools, however, are not supplied by GMC Truck and Coach Division. Information regarding availability of these tools can be obtained from the Zone Office or from the Technical Publications Department at the factory.

Tool No.	Tool Name
J-9396	Holding Fixture
J-9403	Clutch Hub Holding Tool
J-9399	Compressor Shaft Nut Socket
J-9401	Hub and Drive Plate Assembly Remover
J-5403	Internal Snap Ring Pliers
J-9480-01	Hub & Drive Plate Assembly Installer
J-6435	External Snap Ring Pliers
J-9395	Pulley Pilot
J-8433	Pulley Puller
J-9398	Pulley Bearing Remover
J-8092	Driver Handle
J-9481	Pulley Bearing and Pulley Installer
J-23128	Seal Seat Remover and Installer
J-9553	O-Ring Remover
J-9392	Shaft Seal Remover and Installer
J-22974	Seal Protector
J-21508	O-Ring Installer
J-5139	Oil Pickup Tube Remover
J-9397	Compressing Fixture
J-9402	Piston Assembly Tray
J-9432	Needle Bearing Installer

AIR CONDITIONING SPECIFICATIONS (MODEL PD-4108)

REFRIGERANT COMPRESSOR

GM Part No.	5910771
Make	Frigidaire
Type	6 Cylinder Axial
Displacement	12.6 cu. in.
Rotation (Viewing Drive End)	Counterclockwise

COMPRESSOR CLUTCH COIL

Ohms (at 80° F.)	3.85
Amps (at 80° F.)	3.2 12 Volt

DEHYDRATOR STRAINER

Make	Alco Valve Co.
Type	Disposable

EXPANSION VALVE

Make	Alco Valve Co.
Superheat Adjustment	External
System Superheat Setting	15°-19°

HI-LO Pressure Switch

GM Part No.	676550
Make	Ranco Controls
Type	017-110
High Pressure Switch:	
Opens at	425 ± 5° psi (gauge).
Closes at	Approx. 275 ± 5 psi (gauge)
Low Pressure Switch	
Differential Range	5-35
Cut-In	30 ± 5 lbs.
Cut-Out	10 ± 5 lbs.

CONDENSER FAN DRIVE MOTOR

Make	Prestolite
Model	MJY-4001
Low Speed	
Volts	25.5-27.5
Amps (Armature)	40-50
Amps (Field)	6.0-8.0
Fan RPM	1775-1850

CONDENSER FAN DRIVE MOTOR (CONT.)

High Speed	
Volts	25.5-27.5
Amps (Armature)	78-88
Amps (Field)	2.5-4.5
Fan R.P.M.	2350-2425

CONDENSER FAN PRESSURE SWITCH

Make	Ranco
Model	010-1025
Cut-Out Pressure	295 ± 5 psi
Cut-In Pressure	325 ± 5 psi

AIR COND. CLUTCH RELAY AND AIR COND. CLUTCH HOLD RELAY

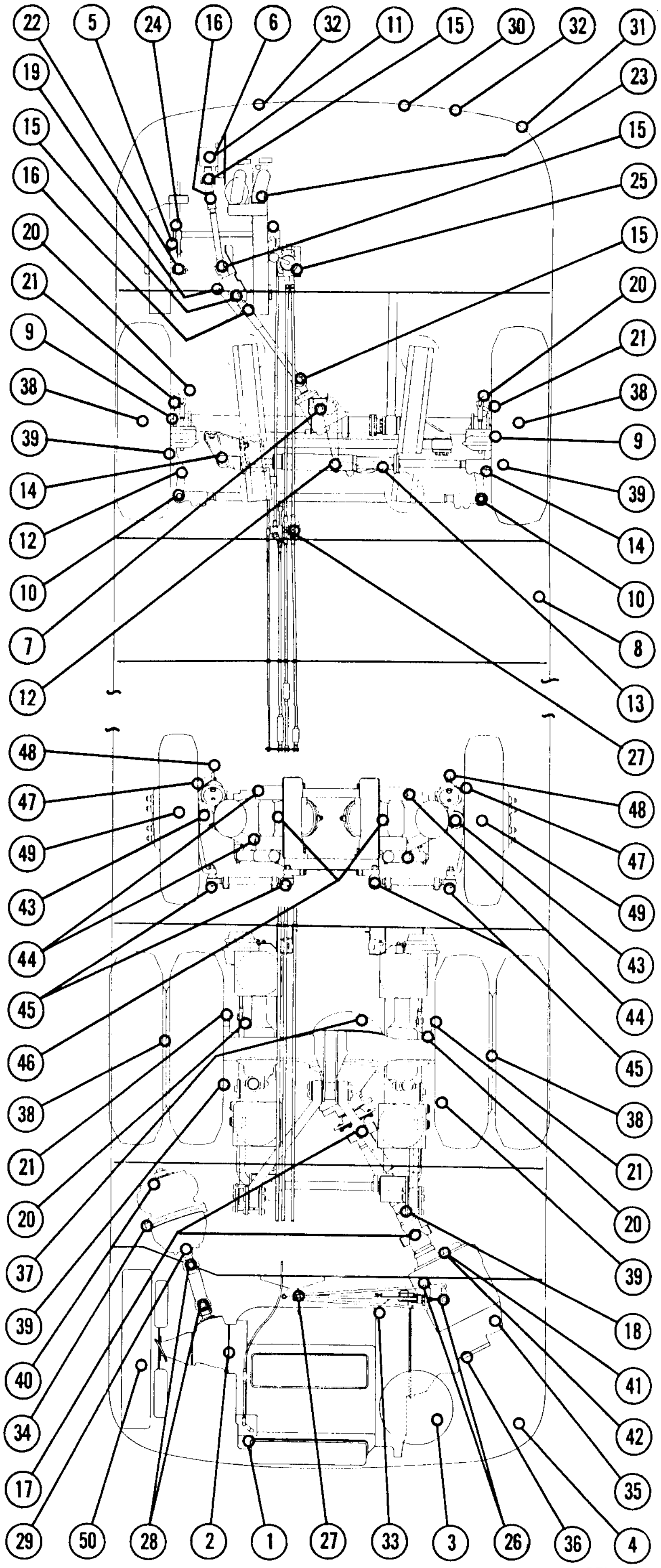
Make	Delco-Remy
Model	1116964
Air Gap at Core—	
Points Closed (In.)	(0.011 Min.)
Point Opening (In.)	0.030
Closing Voltage (Range)	15.5-18.5
Opening Voltage	1.5 (Min.)
Sealing Voltage	22.5 (Max.)

GENERATOR CONTROL RELAY

Make	Delco-Remy
Model	1116969
Air Gap at Core—	
Points Closed (In.)	0.011 (Min.)
Point Opening (In.)	0.025
Closing Voltage (Range)	8.8-10.2
Opening Voltage	0.6 (Min.)
Sealing Voltage	11.2 (Max.)

CONDENSER FAN HI-SPEED RELAY

Make	Delco-Remy
Model	1115860
Point Opening (In.)	0.020-0.030
Sealing Voltage	14-18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LUBRICATION CHART
(MODELS PD4108 AND PD4905)

Item No.	Item	Remarks	Miles	Sym.
1	Engine	Keep to "FULL" mark	Daily	E
		Less By-Pass Filter - 28 Qts.		
		With By-Pass Filter - 36 Qts.		
2	Oil Filter	Replace element at engine drain	4,000	E
3	Blower Air Cleaner	Keep to "Level" mark - 6 qts.	3,000	E
4	Power Steering System	Keep to "FULL" mark	3,000	S19
5	Control Rod Linkage (Brake)	Brush or spray	3,000	E
6	Steering Column Bevel Gear Housing	To level of breather	15,000	SG
7	Steering Gear Housing (At Axle)	To level of breather	15,000	SG
8	Battery Terminals	Keep coated	3,000	S3
9	Steering Knuckles	Two fittings each side	3,000	MPG#
10	Steering Tie Rod Ends	One fitting each end	3,000	MPG#
11	Steering Column U-Joint	1 fitting	3,000	MPG
12	Steering Drag Link Ends (Manual Stg.)	One fitting each end	3,000	MPG#
13	Steering Drag Link Ends (Power Stg.)	One fitting - hand gun - sparingly	3,000	SG
14	Steering Booster Ends (Power Stg.)	One fitting each end	3,000	MPG#
15	Steering Prop. Shaft U-Joints	One fitting each joint	3,000	MPG#
16	Steering Prop. Shaft Joint	One fitting each joint	3,000	MPG#
17	Prop. Shaft U-Joints	One fitting each joint	3,000	MPG
18	Prop. Shaft Slip Joint	One fitting	3,000	MPG
19	Steering Prop. Shaft Support Bearing	One fitting	3,000	MPG#
20	Slack Adjusters - F. & R.	One fitting each	3,000	MPG
21	Brake Camshafts - Front & Rear	One fitting each - sparingly	3,000	MPG
22	Clutch Pedal	One fitting	3,000	MPG
23	Accelerator Pedal	Thru plug	3,000	MPG
24	Clutch Control Cross Shaft	One fitting each end	3,000	MPG
25	Transmission Control Tower	One fitting	3,000	MPG
26	Transmission Control Levers	Two fittings	3,000	MPG
27	Clutch & Transmission Control Bell Cranks	7 fittings (4 front - 3 rear)	3,000	MPG
28	Air Cond. Compressor Drive U-Joints (*)	Two fittings	3,000	S29
29	Air Cond. Compressor Clutch Shaft (*)	One fitting - very sparingly	3,000	S29
30	Destination Sign Gears	Apply	3,000	MPG
31	Front Door Hinges	One fitting each hinge	3,000	MPG
32	Windshield Wiper Shafts	2 fittings (sparingly) (inside coach)	6,000	MPG
33	Starter	See instructions in Section 7	---	E
34	Air Cond. Clutch Air Cylinder (*)	Thru plug opening - 1 oz.	10,000	E
35	Transmission	To mark on dipstick	3,000	E**
		Drain and refill - 11½ Qts.	15,000	E**
36	Transmission Oil Filter	Replace assembly	4 000	-
37	Rear Axle Differential	To level of filler plug	3,000	MPO
		Drain and refill - 22 pts.	15,000	MPO
38	Wheel Bearing - F. & R.	Hand pack or use lubricator Do not use pressure gun	15,000	MPG
39	Brake Shoe Anchor Pins	8 fittings - 2 each wheel	15,000	MPG
40	Air Conditioning Compressor (*)	See instructions	---	S25
41	Speedometer Adapter	One fitting	3,000	MPG
42	Tachometer Cable (When Used)	Coat inside cable	25,000	SG
43	Axle Ball Joints - Upper & Lower	2 fittings each side	3,000	MPG
44	Axle Bearing Brackets	2 fittings each side	3,000	MPG
45	Axle Toe-In Link Ends	1 fitting each end (each side)	3,000	MPG
46	Axle Lifting Sliders	1 fitting each side	3,000	MPG
47	Brake Camshafts	1 fitting each - Sparingly	3,000	MPG
48	Brake Slack Adjusters	1 fitting each	3,000	MPG
49	Wheel Bearings	Hand pack or use lubricator Do not use pressure gun	15,000	MPG
50	Radiator Shutter Air Filter (When Used)	Remove plug - inject 1½ oz. fluid	3,000	S13

(*) PD4905 Only (4108 requires no external lubrication).
#Use "SG" steering gear lubricant during extreme cold weather.
** S.A.E. 20, Oct. to Mar. - S.A.E. 30, Apr. to Sept.

X-7014

E - Engine Oil
MPG - Multi-Purpose Grease
MPO - Multi-Purpose Gear Oil
SG - Steering Gear Lubricant
S3 - Petrolatum - Petroleum Jelly

S13 - Radiator Shutter Fluid
S19 - Automatic Transmission Fluid
S25 - Air Conditioning Compressor Oil
S29 - Special Grease

T-7225